A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
1.	Dr. Steven A Ackerman *UW-Madison, CIMSS, AOS*	MODIS and CALIOP Observations of Clouds over the Great Lakes	Poster	The Great Lakes collectively form one of the largest reservoirs for fresh water in the world. There are numerous large metropolitan areas with significant industry harboring on the Great Lakes. In the absence of strong synoptic flow, the weather in these major cities, like surrounding coastal communities, is conditioned as a function of the Great Lakes water temperature. Lake breezes modify shoreline wind conditions in response to a differential horizontal heat flux between land and water as the land heats warmer than water. Like all mesoscale meteorological features, the resulting temperature and wind can differ between coastal and near-coastal locales less than five miles apart. This variety in conditions poses numerous problems in the forecast process and is consistently liable to deter recreation and commerce near the Great Lakes through conditions which are rarely hazardous, but often uncomfortable. During winter, synoptic flow patterns can bring cold arctic air over the relatively warm Great Lake waters, forming boundary layer clouds leading to lake effect snow falls. This presentation describes an investigation of the changing cloud properties during winter cold air outbreaks as they move over the Great Lakes. A unique MODIS data set is compiled to explore how cloud amount, cloud top pressure, cloud optical thickness and effective radius change downwind of the coast line. Collocated MODIS and CALIOP observations are used to validate the large MODIS alone data set. The MODIS/CALIOP data set is also used to characterize cloud and boundary layer properties across a lake-breeze front.

A-Train 2010 Abstract Submissions

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2.	Dr. Changwoo Ahn *SSAI - NASA/GSFC*	Identification of Aerosol Types Using OMI Aerosol Index and AIRS Carbon Monoxide Data	Poster	Ultraviolet (UV) aerosol products including Aerosol Index (AI), single scattering albedo and absorption optical depth from the Ozone Monitoring Instrument (OMI) onboard the Aura spacecraft provide unique information for understanding the global effect of absorbing aerosols on Earth's radiation budget. The UVAI is an excellent tool for separating non-absorbing sulfate type aerosols near the surface from elevated absorbing aerosols such as smoke from the biomass burning and large scales of dust storms. However, it is difficult to separate smoke from dust type aerosol with current limited spectral dependence of those particles in the near-UV wavelengths used for retrieval processes, and occasionally it produces a large uncertainty of OMI retrievals in time and space because of the inaccuracy of identified aerosol types. Therefore, an accurate identification of aerosol types is needed for improving retrieved aerosol properties from OMI. The current OMI UV algorithm uses some pre-defined empirical rules such as geographic/seasonal distributions, and surface ecological types for the identification of aerosol types, however, it has not been very satisfactory to estimate reasonable aerosol types because of their heterogeneity of spatial and temporal variability. An integrated approach that combines multi-sensors measurements is therefore essential for this purpose. In this study, we have found a high degree of spatial correlation between elevated OMI AI and the Atmospheric Infrared Sounder (AIRS) carbon monoxide (CO) levels over smoke regions and it enables to separate smoke from dust with a very reasonable accuracy. The combined method of Aura/OMI AI and Aqua/AIRS CO data has been implemented in the operational OMI UV algorithm. An initial evaluation of the improved OMI aerosol types by making comparison with AERONET Angstrom data at selected sites and regions will be presented.

A-Train 2010 Abstract Submissions

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3.	Dr. Ruhul Amin *NRL, Stennis Space Center, MS*	Impacts of Atmospheric Corrections on HICO Data	Poster	The Hyperspectral Imager for the Coastal Ocean (HICO) has been operating aboard the International Space Station since installation on 24 September 2009. HICO provides 100 m resolution hyperspectral imagery optimized for the coastal ocean. However, accurate retrieval of bio-optical properties from these ocean color imagery relies on accurate atmospheric correction; a small inaccuracy in atmospheric correction can lead to significant errors in the retrieved products. In this study we examine results from various atmospheric correction approaches applied to HICO data, and compare the results to those from the standard multispectral atmospheric correction. One approach was to “hyperspectralize” the standard multispectral atmospheric correction algorithms applied to SeaWiFS and MODIS imagery. This involved adapting the standard multispectral Gordon/Wang NIR atmospheric correction by spline interpolation of the aerosol and Rayleigh radiances using the MERIS input aerosol and Rayleigh tables as “control points”. A second approach is to automate the Cloud and Shadow atmospheric correction methods. This is a scene-dependent method that requires accurate detection of cloud and shadow, but no additional ancillary information (such as aerosol optical depth, ozone, etc.). Although clouds are relatively easy to detect, detecting their shadows over water is quite challenging. We developed an approach that works reasonably well over homogeneous water bodies. It is based on the fact that the sensor radiance measured over water pixels is composed of three components: the direct and diffuse radiance, and the path radiance, while the radiance of corresponding shadow pixels consists of just the reflection of the diffuse sky light and the path radiance. Since HICO is hyperspectral, we found that integrating the blue channels and applying a sliding box (normalizing the integrated value by the mean) enables us to automatically detect cloud shadows in the imagery. In this study we present some preliminary results comparing these various atmospheric correction approaches.

A-Train 2010 Abstract Submissions

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4.	Prof. Kazuma Aoki *University of Toyama*	Aerosol optical properties measured by ground-based and ship-borne sky radiometer	Poster	Aerosol and cloud optical properties are studied using data from ground-based and ship-borne sky radiometer (Prede Co. Ltd., Tokyo, Japan) measurements. We provide the information, in this presentation, on the optical properties of ground, mountain and maritime aerosol with respect to their temporal and spatial variability. The global distributions of aerosol have been derived from satellite data (e.g. MODIS, GOSAT/CAI), and have been simulated in numerical model, which assume optical parameters. However, these distributions are difficult to derive because of variability in time and/or space. Therefore, a ground-based and ship-borne measurement of aerosol is necessary to validate satellite and numerical model. We started the monitoring of aerosols optical properties since 1994, by using a ship-borne sky radiometer (http://skyrad.sci.u-toyama.ac.jp/). The sky radiometer is an automatic instrument that takes observations only in daytime under the clear sky. Observation of aureole interval was made every ten minutes (or five minutes) by once. There were used to measure direct solar irradiance and diffuse solar radiance. Ship-borne type, GPS provides the position with longitude and latitude and heading direction of the vessel, and azimuth and elevation angle of sun. Horizon sensor provides rolling and pitching angles. The aerosol optical characteristics were computed using the SKYRAD.pack version 4.2 developed by Nakajima et al. (1996). In this study, we present the temporal and spatial variation and the relationship of Ångsröm parameters (i.e., aerosol optical thickness and Ångström exponent) over the land (some Asian site), mountain (Mt. Tateyama) and ocean onbored R/V Mirai (JAMSTEC).

A-Train 2010 Abstract Submissions

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5.	Dr. Melody A Avery *NASA*	Evaluation of CALIPSO V3.01 Ice Water Content and Comparisons with CLOUDSAT, MLS, MODIS and In Situ Measurements	Poster	The CALIPSO project has recently added a new cloud ice water content product to the V3.01 data release. CALIPSO ice water content (IWC) is parameterized from CALIOP lidar cloud extinction retrievals (Young and Vaughan, 2009). The parameterization is derived from in situ cloud probe measurements from a variety of aircraft field campaigns (Heymsfield, Winker and Van Zadelhoff, 2005). While the CALIOP space-based lidar does not have enough signal-to-noise ratio to measure the most tenuous sub-visible cirrus (Davis, 2010), and the signal attenuates in thick convective clouds, the lidar is more sensitive to UT/LS thin cirrus than the cloud profiling radar on CLOUDSAT. Further, the lidar can resolve multiple cloud layers, unlike the MODIS instrument, and has very high vertical resolution (60m) in the UT/LS, unlike the microwave MLS instrument (2-3 km vertical resolution). While there are currently several ongoing projects to produce global IWC distributions based on multiple sensors, the straightforward nature of the extinction-based CALIPSO IWC parameterization is ideal for assessing regional distributions and temporal variability in UT/LS cirrus cloud ice water content. To be meaningful, CALIPSO IWC measurements need to be evaluated in comparison with the other available data sets. In this presentation we show global-scale statistical comparisons of CALIPSO IWC with MLS, CLOUDSAT and MODIS IWC during the month of August 2007. We also show a case study from the August 2007 TC4 aircraft field mission where there is a close coincidence between the CALIPSO measurements and the NASA aircraft flight tracks. This case study allows a closer analysis of CALIPSO IWC measurement accuracy in tropical convection by comparison with IWC from CLOUDSAT, as derived using the CALIPSO parameterization with extinction measurements by the Cloud Physics Lidar, and with in situ IWC measurements.

A-Train 2010 Abstract Submissions

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6.	Dr. Bryan A Baum *University of Wisconsin-Madison*	Development of Consistent Ice Cloud Bulk Scattering Models for A-Train Sensors	Poster	This work focuses on improvements to our methodology for building both spectral and narrowband bulk scattering optical models appropriate for satellite imagers and hyperspectral infrared (IR) sensors. These ice cloud bulk scattering models are based on a comprehensive set of microphysical models developed from in situ measurements of ice clouds, and light scattering calculations that include droxtals, solid/hollow columns, plates, solid/hollow bullet rosettes, aggregates of columns, and aggregates of plates. In-situ measurements are incorporated from a variety of field campaigns, including ARM-IOP, CRYSTAL-FACE, ACTIVE, SCOUT, MidCiX, pre-AVE, and TC-4. The light scattering calculations have been improved by including the full phase matrix as well as incorporating a new treatment of forward scattering. The single-scattering properties now include surface roughness. The bulk scattering models discussed include applications to imagers such as MODIS and IR interferometers such as the Atmospheric Infrared Sounder (AIRS). Comparisons are made between our models and measurements from Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) data, specifically P11 and P22/P11 at the backscattering angle. For generalized habit mixture and midlatitude habit mixtures, moderately roughened particles tend to correspond best with the CALIOP measurements, while for the tropical ice clouds, severely roughened particles tend to correspond best. The assumption of smooth particles provide the largest departure from CALIOP measurements.
7.	Prof. Ralf Bennartz *University of Wisconsin*	A sharper view of fuzzy objects: Synergistic use of A-Train measurements to study warm clouds	Talk	Clouds are arguably one of the most important factors modulating the earth's energy balance. Yet, our understanding of cloud forcings and potential feedbacks is still poor. Satellite data provide the only means to globally observe cloud properties. Significant progress has been made in the field of satellite remote sensing over the last decade. In particular, the A-Train constellation has become an invaluable tool to study clouds and cloud processes. It provides the unprecedented opportunity to nearly simultaneously observe clouds from active and passive instruments spanning the entire range from the visible to the microwave part of the electromagnetic spectrum. The synergistic use of these different measurements helps to significantly narrow down uncertainties in retrieved cloud properties and allows for the derivation of new parameters that could not be derived from one instrument alone. This presentation will focus on three new products and related climatologies developed in our group: cloud droplet number concentration, cloud liquid water path, and rain water path. The role of these datasets in climate research will be discussed and application examples both at the cloud process level as well as the climate system level will be given.

A-Train 2010 Abstract Submissions

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8.	Dr. Rohini L Bhawar *Post-Doctoral Researcher*	Tropical Upper Tropospheric Clouds Observed by CALIPSO, Aura MLS and CloudSat and their Radiative Effects	Poster	The three NASA A-train satellites, CALIPSO, Aura MLS and CloudSat fly in formation and provide unprecedented 3-dimensional measurements of cloud profiles nearly simultaneously. The newly released CALIPSO V3.01) Ice Water Content (IWC) profile in conjunction with Aura MLS and CloudSat data is used to describe spatial distribution and temporal variations of tropical upper tropospheric clouds, and the relationships of clouds with large-scale environmental conditions. We find that CALIPSO is sensitive to thin cirrus clouds, maximum cloud occurrence frequency peaking around cloud optical depth 0.004. The differences among these three satellite measurements are documented. We use the three measurements as inputs to the Fu-Liou radiation model and estimate impacts of UT clouds on radiation.
9.	Mr. Lei Bi *Department of Physics and Astronomy, Texas A&M University*	Backscatter Color Ratio of Ice Crystals at the Wavelengths of 0.532 and 1.064 μm	Poster	The color ratio, defined as the ratio of the backscatter coefficients of a scattering medium at the two wavelengths of 1.064 and 0.532 μm, is a critical quantity in the CALIOP lidar algorithms. Traditionally, this value is assumed to be unity based on the principles of Conventional Geometric Optics Method (CGOM). It is found that the color ratio values are less than unity with a peak value near 0.7 for columns and 0.8 for plates in the context of Physical-Geometric Optics Hybrid (PGOH) method. Physically, the deviation in the value of color ratio from unity is primarily due to different degree of diffraction (or, ray-spreading) effects of light beams at the backscattering direction for the two wavelengths. The degree of ray-spreading effect at the wavelength of 1.064 μm is larger than that at 0.532 μm because of smaller size parameter at the former wavelength. Results from theoretical studies are qualitatively consistent with measurements from a ground-based lidar housed at Hampton University, Hampton, Virginia.
10.	Lisa Booker *National Snow and Ice Data Center*	A-Train Data at NSIDC: An Overview of AMSR-E and MODIS data and services	Poster	The Moderate Resolution Imaging Spectroradiometer (MODIS) and the Advanced Microwave Scanning Radiometer – Earth Observing System (AMSR-E) are two mission instruments flying aboard NASA's Aqua satellite in the A-Train satellite formation. The National Snow and Ice Data Center (NSIDC) Distributed Active Archive Center (DAAC) archives and distributes Level-2 and 3 snow cover and sea ice products from MODIS and all standard products from AMSR-E, including Level-1A, 2, and 3 data. NSIDC maintains Web pages to access MODIS and AMSR-E data and information. This poster presentation will provide data users with an overview of AMSR-E and MODIS products, data access methods, and data services at NSIDC.

A-Train 2010 Abstract Submissions

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11.	Dr. Eva E Borbas *SSEC, UW-Madison*	Estimation of the altitude of high thin clouds at night time from VIIRS and CrIS	Poster	Estimation of cloud properties continues to challenge algorithm developers. VIIRS has no infrared spectral bands sensitive to atmospheric carbon dioxide, water vapor (WV), or ozone; it only has infrared window (IRW) channels. VIIRS cloud height algorithms will then have to rely on the spatially coarser resolution CrIS measurements; a VIIRS/CrIS combined, reduced resolution cloud algorithm has been developed and tested. The combined VIIRS/CrIS methodology offers the opportunity for cloud products improved over those from either system alone. MODIS and AIRS data is used to test VIIRS and CrIS capabilities and study the results in global data sets. Several methods have been tested combining AIRS cloud top pressures (CTP) with MODIS brightness temperature (BT) at 11 μm. The results from a lapse rate (calculated from AIRS retrievals) method for four different cloud layers and a statistical regression method of three channels (band 29, 31, and 32) are compared to AIRS-only and the MODIS-only CO2 slicing 1km cloud products (used as truth). The AIRS-only CTPs are derived by the UW IMAPP AIRS Utilities V1.1. The preliminary results show that the biases of the two methods are very similar but the four-layer lapse rate method produces smaller standard deviations. We will present the evaluation of the 4-layer lapse rate method and the 3-channel regression method over different ecosystems and seasons and we will compare results to the CALIOP for selected granules.
12.	Dr. Diana Boukaram *LSCE/CEA*	The radiative impact of airborne dust on the Saharan cyclone on February 2007.	Poster	The dust activity over North Africa associated with the Saharan depression event in February 2007 is investigated by mean of spaceborne observations and ground based measurements. The dust storm and cloud cover over North Africa is thoroughly described combining for the first time Spinning Enhanced Visible and Infra-Red Imager (SEVIRI) images for the spatio-temporal evolution and Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) and CloudSat observations for the vertical distribution. The radiative forcing of dust and its feedback on the cyclone dynamics has been evaluated using a mesoscale model. The comparison between the simulations with and without dust has suggested that the radiative impact of dust represents important implications on the dynamics and the lifetime of the cyclone. The dust layer associated with the cyclone produced a local warming of the atmosphere up to 3.5 °C and it was responsible of the deepening of the depression by 1.5 hPa. Also, the dust favored the development of clouds by up to 3% and enhanced winds at 925 hPa by 6 m s-1 suggesting dust self-lofting. Key Words: Mediterranean cyclone, CloudSat, ECMWF, North Africa, Sharav cyclone, CALIPSO, MesoNH.

A-Train 2010 Abstract Submissions

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13.	François-Marie Breon *LSCE / IPSL / ICARE*	An evaluation of satellite aerosol products against sunphotometer measurements	Poster	Because atmospheric aerosol scatter sunlight to space, reflectance measurements from spaceborne radiometer can be used to estimate the aerosol load and its optical properties. Several aerosol products are generated in a systematic way, and are available for further studies. In this paper, we evaluate the accuracy of such aerosol products derived from the measurements of POLDER, MODIS, MERIS, SEVIRI and CALIPSO, through a statistical comparison against Aerosol Optical Depth (AOD) measurements from sunphotometer. Although the method is very common, this study is, to our knowledge, the most extensive of its type since it compares the performance of 5 sensors using up to five years of data for each of them at the global scale. We distinguish retrievals over land and ocean and the estimates of total and Fine Mode AOD. Over the oceans, POLDER and MODIS retrievals are of similar quality, with RMS lower than 0.1 and a correlation around 0.9. The POLDER estimates suffers from a high bias for clean atmospheres, which degrades its statistics. Other aerosol products are of lesser quality, although the SEVIRI products can be of interest for some applications that require a high temporal resolution. MERIS product shows a very high bias. Over land, only the MODIS product offers a reliable estimate of the total AOD. On the other hand, the polarization-based retrieval using POLDER data allows a better Fine Mode estimate than that from MODIS. These results suggest the development of a product combining POLDER and MODIS products over land.
14.	Ms. Ciara E Brown *Hampton University*	The effect of spatial resolution in the accuracy of satellite measured Aerosol Optical Depth	Poster	The effect of spatial resolution in the accuracy of satellite measured aerosol optical depth (AOD) was studied using data from two A-train sensors, Ozone Monitoring Instrument (OMI) on the Aura satellite and Moderate Resolution Imaging Spectroradiometer (MODIS) on Aqua. OMI and MODIS AOD retrievals were compared to AERONET observations at Goddard Space Flight Center in Maryland for years 2006 through 2009. The main source of error in the retrieval of AOD from satellite measurements is subpixel cloud contamination that causes over estimation of AOD values, especially for OMI which has a 13 X 24 km2 footprint. An increase in resolution decreases the size of the footprint and thus the number of cloud contaminated pixels. Therefore, the main objective of this study is to analyze the effect of the large footprint size (field of view of the instrument) in the accuracy of aerosol retrievals over land. We have also examined the assumption that throughout the large field of view the aerosols are homogenous. The 2010 DRAGON [Distributed Regional Aerosol Gridded Observation Networks] field campaign, which includes a mesoscale gridded network of sun photometers, collected data for several weeks over the Washington DC metropolitan area. Making use of this data we have shown that the spatial homogeneity assumption is not always valid.

A-Train 2010 Abstract Submissions

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15.	Madeline Brozen *NASA Develop Program*	Gulf of Mexico Ecological Forecasting: Synthetic Aperture Radar Data Decision Support for Atlantic Bluefin Tuna Population Assessment and Management in the Gulf of Mexico	Poster	Atlantic Bluefin Tuna (Thunnus thynnus thynnus) is one of the largest vertebrates in the world and is in high demand in sushi markets. It is a highly political species and is managed internationally by the International Commission for the Conservation of Atlantic Tuna. The Gulf of Mexico and the Mediterranean Sea are the only two known spawning sites in the world; however, there is a large variance in estimates of adult Atlantic Tuna spawning. This research focuses on extending Earth science research results to existing National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) decision-making system for population assessment and management of Atlantic Bluefin Tuna. The research team is a multi-sector and multi-disciplinary team composed of government (NOAA_NMFS), academic (University of South Florida Institute for Marine Remote Sensing) and commercial (Roffer's Ocean Fishing Forecasting Service, Inc.). Their goal is to reduce the variance in the estimates of adult Bluefin Tuna spawning stock abundance in the Gulf of Mexico (GOM). Therefore, this paper will be derived from the innovative use of several earth orbiting satellites focusing on the use of synthetic aperture radar (SAR) data to identify Sargassum, which is a floating marine algae that may be relevant to the presence of Bluefin Tuna aggregations. The SAR imagery will be examined in combination with MODIS and MERIS Chlorophyll-a products to detect fine-scale surface current shear, eddy and frontal features as well as biological slicks due to the presence of Sargassum. The fine-resolution, all-weather capabilities of SAR provide a valuable complement to optical/IR sensors, which are often impacted by cloud cover. This study will provide an assessment of whether or not SAR can contribute to decision support efforts relevant to commercial fisheries through the improvement of the understanding of environmental conditions relative to Tuna. SAR from Envisat ASAR and ERS-2 SAR data over the Gulf of Mexico (and Gulf Stream) regions will be analyzed that is coincident with various reporting of the presence of Sargassum.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

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16.	Madeline Brozen *NASA Develop Program*	Pacific Ecological Forecasting: Multisensor Oceanographic Correlations for Pacific Hake Acoustic Survey Improvement	Poster	North Pacific hake (Merluccius productus), the most abundant groundfish along the Pacific coast of northwestern America, are an essential source of income for the coastal region from southern California to British Columbia, Canada. However, hake abundance and distribution are highly variable among years, exhibiting variance in both the north-south and east-west distribution as seen in the results from biannual acoustic surveys. This project is part of a larger undertaking, ultimately focused on the prediction of hake distribution to improve the distribution of survey effort and precision of stock assessments in the future. Four remotely sensed oceanographic variables are examined as a first step in improving our understanding the relationship between the intensity of coastal upwelling and other ocean dynamics, and the north-south summer hake distribution. Sea surface height, wind vectors, chlorophyll – a concentrations, and sea surface temperature were acquired from several satellites, including AVHRR, SeaWifs, TOPEX/Poseidon, Jason-1, Jason-2, SSM/I, ASMR-E, and QuikScat. Data were aligned to the same spatial and temporal resolution, and these re-gridded data were then analyzed using empirical orthogonal functions (EOFs). EOFs were used as a spatio-temporally compact representation of the data and to reduce the co-variability of the multiple time series in the dataset. The EOF results were plotted and acoustic survey results were overlaid to understand differences between regions. Although this pilot project used data from only a single year (2007), it demonstrated a methodology for reducing dimensionality of linearly related satellite variables that can used in future applications, and provided insight into multi-dimensional ocean characteristics important for hake distribution.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

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17.	Dr. Virginie j Buchard-Marchant *NASA/GEST*	Simulations of the Aerosol Index and the Absorption Aerosol Optical Depth and comparisons with OMI retrievals during ARCTAS-2008 campaign.	Poster	We have computed the Aerosol Index (AI) at 354 nm, useful for observing the presence of absorbing aerosols in the atmosphere, from aerosol simulations conducted with the Goddard Chemistry, Aerosol, Radiation, and Transport (GOCART) module running on-line the GEOS-5 Atmospheric GCM. The model simulates five aerosol types: dust, sea salt, black carbon, organic carbon and sulfate aerosol and can be run in replay or data assimilation modes. In the assimilation mode, information's provided by the space-based MODIS and MISR sensors constrains the model aerosol state. Aerosol optical properties are then derived from the simulated mass concentration and the AI is determined at the OMI footprint using the radiative transfer code VLIDORT. In parallel, model derived Absorption Aerosol Optical Depth (AAOD) is compared with OMI retrievals. We have focused our study during ARCTAS (June – July 2008), a period with a good sampling of dust and biomass burning events. Our ultimate goal is to use OMI measurements as independent validation for our MODIS/MISR assimilation. Towards this goal we document the limitation of OMI aerosol absorption measurements on a global scale, in particular sensitivity to aerosol vertical profile and cloud contamination effects, deriving the appropriate averaging kernels. More specifically, model simulated (full) column integrated AAOD is compared with model derived AI, this way identifying those regions and conditions under which OMI cannot detect absorbing aerosols. Making use of A-Train cloud measurements from MODIS, CloudSat and CALIPSO we also investigate the global impact on clouds on OMI derived AI, and the extent to which GEOS-5 clouds can offer a first order representation of these effects.
18.	Sharon Burton *NASA Langley Research Center*	Retrieval of aerosol extinction from CALIPSO version 3.01 using MODIS AOT constraint	Poster	We have derived aerosol extinction profiles from CALIPSO V3.01 backscatter signals by constraining the retrieval with column aerosol optical thickness (AOT) from Aqua MODIS with no need to rely on assumptions about aerosol type or lidar ratio. The resulting profiles are compared with coincident aerosol extinction profiles measured by the NASA Langley Research Center airborne High Spectral Resolution Lidar (HSRL), which measures aerosol extinction coefficients independently using the high spectral resolution technique. This retrieval has been evaluated previously [Burton et al. 2010] using CALIPSO provisional version 2.01 Level 1 data, and compared to the provisional level 2 data. This poster describes an updated retrieval using the recently released CALIPSO version 3.01 data. Reference: Burton, S. P., et al. (2010), Using airborne high spectral resolution lidar data to evaluate combined active plus passive retrievals of aerosol extinction profiles, J. Geophys. Res., 115, D00H15, doi:10.1029/2009JD012130

A-Train 2010 Abstract Submissions

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19.	Dr. Sean Casey *Jet Propulsion Laboratory/California Institute of Technology*	Regional differences in tropical congestus populations as viewed by AIRS/CloudSat coincident scans	Poster	One years' worth of CloudSat measurements over the tropical oceans are analyzed, with a focus on actively convective clouds. These clouds are separated into two categories: congestus, with cloud-top heights less than 8 km, and deep clouds, with heights above 8 km. The ratio of congestus to deep clouds is on average 4.2 to 1. Large regional discrepancies exist, ranging from 3.1 to 1 over the Maritime Continent to 6.7 to 1 over the North Pacific. Atmospheric Infrared Sounder profiles, collocated to the CloudSat profiles, are then analyzed to identify differences in the environment surrounding the clouds. The mean midtropospheric relative humidity (RH) surrounding congestus clouds in the North Pacific is found to be significantly lower than that found over the Maritime Continent. The authors postulate that lower RH values in the North Pacific may lead to a greater occurrence of cumulus congestus clouds.
20.	Mr. Grégory Cesana *LMD / IPSL*	Comparison of two different cloud climatologies derived from CALIOP-Level 1 observations: the CALIPSO-ST and the CALIPSO-GOCCP	Poster	Two different cloud climatologies have been derived from the same NASA-CALIOP- level 1-version 2 dataset. The first climatology (CALIPSO-ST) is developed by the CALIPSO Science Team using the standard CALIOP Level 2 products. CALIPSO-ST aims to document clouds with the highest possible spatio-temporal resolution, taking full advantage of CALIOP capabilities and sensitivity. The second climatology, the GCM Oriented Calipso Cloud Product (CALIPSO-GOCCP), is aimed at evaluating GCM predictions of cloudiness. For this specific purpose it has been designed to be fully consistent with the CALIPSO simulator included in COSP (CFMIP Observation Simulator Package) used within the Cloud Feedback Model Intercomparison Program (CFMIP). The two datasets exhibit somewhat different cloud distributions due to the different objectives and differences in the algorithms used. Both algorithms have been documented in previous papers. The current study aims at explaining to users how to interpret the differences between the two datasets. A detailed comparison between the two datasets will be presented based on 1 year of observations (Sept 2006 to August 2007). The results obtained with the 2 different cloud masks will be examined for selected orbits dedicated to specific cloud types: tropical oceanic shallow cumulus, optically thin high altitude cirrus, polar clouds, mid-level clouds in the storm-tracks, deep convective clouds etc… The global seasonal statistics obtained with the 2 algorithms will be compared quantitatively: total cloud cover, low (P>680 hPa), mid (680 < P<440 hPa), high (P< 440 hPa) cloud cover, and the cloud vertical distribution. The results of the comparison will be discussed in terms of cloud detection thresholds, horizontal and vertical averaging, and lidar sensitivity.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

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21.	Dr. Robert B Chatfield *NASA Ames Research Center*	Using GAMs to Combine Multiple A-Train Products for More Accurate PM2.5 Air Quality Measurements	Poster	Previous studies have emphasized the low skill of the MODIS aerosol products in describing PM2.5 in the Western US; correlation coefficients of ~0.2 are common. (PM2.5 = respirable-particle mass with diameter smaller than 2.5 microns.) Our expectation has been that California's different surface properties (often drier and brighter), different chemistry (nitrate and ammonium compounds are important), the presence of elevated layers (from valley recirculation, or from Asian via the Pacific Anticyclone) could be at work. We discovered that we could use multiple remotely retrieved products to increase predictability. We expected some nonlinearity in the most appropriate statistical models each retrieved variable could have unique properties of noise (random scatter at low levels, occasional unrepresentative or "wild" points at high levels). Indeed, we found that we could reach at least r = 0.74, r2 = 0.54 in estimating PM2.5 as measured for a relatively large dataset describing aerosol mass loading in the polluted San Joaquin Valley of California. PM2.5 measurements were available from October, 2004 through 2009. We were able to explain thousands of PM2.5 measurements from six sites, sampled from Bakersfield to Stockton, throughout the 4 years. We used GAM (generalized additive model) techniques to allow just as much non-linearity as the data warranted (i.e., the generalized cross validation check). r = 0.74 was reached with just nine parameters for ~2200 samples at the sites. We found that Deep Blue retrievals were somewhat more informative, but that Standard MODIS aerosol retrievals were necessary. OMI tropospheric NO2 proved significant, probably indicating nitrate. The inclusion of multiple variables actually made the relation of each variable to PM2.5 appear more physically reasonable. We expect similar methodology to work in other large, polluted regions.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
22.	Dr. Aijun Chen *NASA GSFC/GMU*	Visualization and Synergy of A-Train Earth Science Data on Google Earth	Poster	The NASA A-Train Data Depot (ATDD) has been developed by Goddard Earth Science (GES) Data and Information Service Center (DISC) to process, archive, allow access to, visualize, analyze and correlate distributed atmospheric measurements derived from A-Train instruments. Nearly all A-Train datasets, such as Parasol, MODIS/Aqua, OMI/Aura, and some model data, such as ECMWF, MERRA, are collocated and pre-subsetted about the CloudSat satellite track. The only data that isn't collocated are the AIRS/Aqua data products which are collocated and subsetted in real-time. The collocated data sets are most easily downloaded using the GES DISC's Mirador tool (http://mirador.gsfc.nasa.gov) although FTP access is also provided. The ATDD web portal provides easy on-line data access and services for science, applications, and educational use, so that users get exactly the data they want, and not large files of data which would take much time and effort by individuals to be co-registered and refined for their specific use. The portal site also provides extensive documentation on our data holdings and the A-Train mission in general, together with many relevant links to other A-Train data centers. An image gallery and scientific analyses of a number of interesting meteorological events are supplied too. Giovanni, a web-based infrastructure for online data access and analysis, was used to facilitate the building-up of the A-Train Data Depot. It provides two-dimensional plotting for most of atmospheric parameters, such as cloud profiles, cloud top temperatures, rain rates, water vapor content, etc. It is also able to process model data, such as MERRA, ECMWF, etc. Google Earth, a convenient virtual 3D platform of organizing, visualizing, publishing, and synergizing Earth science data, was used to visualize three-dimensional vertical profiles and two-dimensional swath data in the ATDD. In details, after dedicated Google Earth-based scientific research for several years, we had done some research and implementations, such as a) visualization of two-, three- and four-dimensional Earth science data on Google Earth; b) visualization and synergy of online analyzed results derived from the ATDD; and c) visualization and synergy of results derived from other standard web services (e.g. OGC Web Map Service) supported by GES DISC. All those implementations produce KMZ files that can be opened via Google Earth client and some via Google Earth Plug-in. Now, all A-Train Earth science data are being available to be visualized on Google Earth. Google Earth can be used as both a client and a web browser plug-in. After we successfully implemented visualization of A-Train data products on Google Earth client, now, Google Earth, as a plug-in in web browser, is integrated with the ATDD as a virtual three dimensional platform to facilitate three-dimensional online interactive data analysis and results visualization. Multiple Google Earth windows are available in one browser window for users visualizing, comparing and synergizing their acquired versatile Earth science data online. Based on the ATDD online system, users can interactively select interested data products and input/adjust their requirements to get back

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
23.	Dr. Wei-Ting A Chen *JPL/Caltech*	Partitioning CloudSat Ice Water Content for Comparison with Upper-Tropospheric Ice in Global Atmospheric Models	Poster	CloudSat provides important estimates of vertically resolved ice water content (IWC) on a global scale based on radar reflectivity. These estimates of IWC have proven beneficial in evaluating the representations of ice clouds in global models. An issue when performing model-data comparisons of IWC particularly germane to this investigation, is the question of which component(s) of the frozen water mass are represented by retrieval estimates and how they relate to what is represented in models. The present study developed and applied a new technique to partition CloudSat total IWC into small and large ice hydrometeors, based on the CloudSat-retrieved ice particle size distribution (PSD) parameters. The new method allows one to make relevant model-data comparisons and provides new insights into the model's representation of atmospheric IWC. The partitioned CloudSat IWC suggests that the small ice particles contribute to 20-30% of the total IWC in the upper troposphere when a threshold size of 100 μm is used. Sensitivity measures with respect to the threshold size, the PSD parameters, and the retrieval algorithms are presented. The new dataset is compared to model estimates, pointing to areas for model improvement. Cloud ice analyses from the European Centre for Medium-Range Weather Forecasts model agree well with the small IWC from CloudSat. The finite-volume multi-scale modeling framework model underestimates total IWC at 147 and 215 hPa, while overestimating the fractional contribution from the small ice species. These results are discussed in terms of their applications to, and implications for, the evaluation of global atmospheric models, providing constraints on the representations of cloud feedback and precipitation in global models, which in turn can help reduce uncertainties associated with climate change projections.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
24.	Helene Chepfer *LMD/IPSL*	The A-train observations : a new area to evaluate and to improve the clouds description in climate models.	Talk	The representation of clouds differs among climate models, and the cloud response (and feedback) to anthropogenic forcings remains highly uncertain. It still constitutes the main source of uncertainty for climate sensitivity estimates from climate models, and a major limitation to the reliability of climate change projections. To improve the reliability of climate change projections, it is therefore imperative to improve the representation of cloud processes in models. This first requires to carry out thorough evaluations of the cloud description in climate models. Until recently, the evaluation of the cloud description in climate models has been largely indirect, based on satellite data of the Earth's radiation budget (ERBE, ScaRaB, CERES). Basic aspects of the cloudiness as fundamental as the vertical distribution of the cloud cover were crucially lacking. The A-train open a new area for the évaluation and the improvement of the cloud description in climate models. In this talk, we first show that due to errors compensations, the climate models produce correct top-of the atmosphère fluxes associated to incorrect cloud cover, cloud optical depth and time évolution Then, we show how the A-train observations (CALIPSO, CLoudSat, MODIS, PARASOL, CERES) are used to unravel the errors compensations and to evaluate quantitatively the clouds description in various climate models using the COSP (CFMIP Observation Simulator Package) and the CFMIP-OBS observational dataset, within the CFMIP-2 (Cloud Feedback Model Intercomparison program) and the CMIP-5 (Climate Model Intercomparison Program) experiments. Finally, we show that the A-train do not only contribute to evaluate the clouds description in climate models but can also be used to suggest leads for improvements. For this last purpose, we have analyzed statistically the co-located A-train observations at high spatial résolution to built pictures of the cloud properties at the scale of the cloud process. This multi-instruments dataset at high spatial resolution is then used to assess the cloud parameterization in different versions of a climate model.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
25.	Dr. Isabelle Chiapello *LOA Université de Lille 1/CNRS*	Analysis of PARASOL and OMI/AURA aerosol retrievals in the North West Africa region during AMMA	Poster	Both PARASOL (Polarization & Anisotropy of Reflectances for Atmospheric Sciences coupled with Observations from a Lidar) and OMI (Ozone Monitoring Instrument on board EOS/AURA) were launched in 2004 as part of the A-TRAIN constellation. PARASOL and OMI allow innovative retrievals of aerosol properties. In this analysis we will focus on (i) PARASOL capabilities to derive both aerosol loads (Total Aerosol Optical Thickness) and size (Fine Aerosol Optical Thickness, Angström coefficients) over ocean. (ii) OMI estimates of both aerosol loads (Total AOT) and absorption properties (Single Scattering Albedo). North West Africa is a region of special interest for aerosol studies, characterized by high aerosol loads due to the influence of mineral dust from Sahara and Sahel (all year along), and biomass burning aerosols (during the dry season, i.e., winter). Due to this double influence, the size and absorption properties of the aerosol content may vary significantly. Thus, this region is well adapted to test both PARASOL aerosol size retrievals, and absorption properties of aerosols derived from OMI. In the context of AMMA (African Monsoon Multidisciplinary Analysis) the aerosol measurements have been reinforced over the North West Africa region. Our analysis of satellite retrievals relies mainly on aerosol measurements from the Sun photometers of the AERONET/PHOTONS network. The PARASOL aerosol retrievals are compared over ocean to Sun Photometer measurements from Cape Verde Island and M'Bour (Senegal). The spatial distribution and seasonal variability of PARASOL aerosol derived parameters are examined over the period 2005-2009. Over land surfaces, the Sun photometer measurements of aerosols from Banizoumbou (Niger), Djougou (Benin), and M'Bour (Senegal) are used to assess the PARASOL aerosol retrievals. The OMI aerosol retrievals are examined over the M'Bour site, with special interest for the single scattering albedo retrieved by OMI at 388 nm. We analyse the variability of the OMI absorption compared to that derived by the Sun photometer at 440 nm over the period 2005-2007. Overall, this regional analysis allows a better assessment of the reliability of aerosol size and absorption properties derived from current satellite sensors.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
26.	Ms. Lauren M Childs *NASA DEVELOP National Program*	Colorado Water Resources: NASA Earth Observation Applications to Water Resources Management in the Colorado River Watershed	Poster	The Colorado River contributes water resources to roughly 30 million people in seven states, as well as a water commitment to Mexico. Over the past decade, this region has experienced the most intense drought recorded on historic and tree ring data. Economic impacts from the drought have averaged $750 million per year. A total economic impact of $2 billion was a result of the intense span of drought. Due to uncertain future climate projections, accurate assessment of water availability is crucial to determining how water resources are to be allocated within each individual state. In order to accomplish this goal, accurate assessment of both precipitation and snow is essential. For this project, the DEVELOP team, in partnership with the Colorado River Water Conservation District, measured the accuracy of remote sensing methods compared to in-situ data. The remote sensing and ancillary data were applied to general climate trends detected in the area. In addition, precipitation data from TRMM was correlated with weather station data to determine the utility of TRMM within a high-latitude (roughly 39°-41°N), mountainous region. Subsequent to this correlation, the additional coverage provided by TRMM was added to weather station data to evaluate seasonal precipitation trends over time. Snow cover data from the MODIS instrument was also obtained and examined for trends. Finally, snow water equivalent data from the AMSR-E instrument was gathered and analyzed for trends and then correlated with in-situ snowfall data. Precipitation in the Grand Lake area was found to show a long-term decreasing trend from 1950, with high spatial variability on the magnitude and direction of the trend.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
27.	Ms. Lauren M Childs *NASA DEVELOP National Program*	Haiti Public Health: Remote Sensing of Mosquito Habitat in Artibonite, Haiti	Poster	Malaria is a worldwide distributed infectious disease transmitted by the parasitic mosquito Anopheles albimanus. The country of Haiti, located on the island of Hispañiola and neighboring the Dominican Republic, is the only peninsula in the Caribbean where malaria is endemic, making it an area of major public health concern. There have been reported cases of seasonal outbreaks of malaria in the Artibonite Valley of Haiti during the rainy seasons. Furthermore, this area has the largest amount of malaria cases historically documented by regional hospitals. Located along the western region of Haiti near the Golfe de le Gonâve, Artibonite Valley rests at a low altitude and is engulfed by portions of the Artibonite River. This area of interest experiences abundant rainfall and approximately 80% of its farmland is irrigated specifically for the production of rice and other crops. The large number of rice fields coupled with climate and deforestation in this area establishes excellent breeding grounds for the Anopheles albimanus. The presence of the aforementioned conditions makes the spread of the vector-borne disease, malaria, much more drastic. Due to excessive logging practices and deforestation throughout Haiti, changes in microclimates and rainfall patterns have created areas just like Artibonite Valley where vector-breeding grounds grow rampant. Using NASA satellite imagery, instruments from international agencies, and physical measurements, we can characterize the land, space, and ecology of Artibonite Valley to explain the prevalence of the mosquito by characterizing its range of optimal breeding and mapping its potential habitats.
28.	Dr. Mian Chin *NASA Goddard Space Flight Center*	Trans-Atlantic transport and removal of dust: Using A-train and other satellite data to constrain the model	Poster	We present here a study using A-train and Terra satellite data (MODIS, MISR, CALIPSO) and a global model (GOCART) to characterize the dust emission, transport, and removal processes. We focus on the emission and transport of African dust from the sources to the downwind regions across the Atlantic Ocean. In particular, MODIS aerosol optical depth (AOD) data provides extended spatial coverage, MISR data provides information of non-spherical particle fraction to separate dust from non-dust, and the CALIPSO data provides the vertical dimension of dust plume height near the source, across the ocean, and at the receptor regions. In addition, MISR extends the AOD coverage over the sun-glint area where MODIS has no observation. Since there is no additional dust source during the trans-Atlantic transport, the differences between AOD at the source and receptor regions thus infers the dust deposition. We will use these satellite data to constrain the dust emission, transport, and deposition that are simulated by the GOCART model to better understand these processes.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
29.	Mr. Hyoun-Myoung Cho *Texas A&M University*	Improving MODIS infrared mineral dust detection with spatial variability tests	Poster	Detection of mineral dust aerosols is challenging because they can have short lifetimes, occur over a range of spatial scales, and have strong interactions with local surface and meteorological conditions. Because dust optical properties differ from those of clouds, atmospheric molecules, and the surface, satellite-based spectral dust detection should be possible. Numerous detection methods have been developed with varying degrees of success. However, most algorithms based on Moderate Resolution Imaging Spectroradiometer (MODIS) visible and IR spectral regions misclassify thin dust layers as cloud or clear. To address this problem, a new method has been developed by combining the MODIS IR measurements with information about spatial variability. This combined method uses the spatial variability to detect thin dust layer, and the IR brightness temperatures to discriminate between ice cloud and dense dust layers. CALIPSO dust classification is used to validate this dust detection algorithm.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
30.	Prof. James A Coakley Jr. *Oregon State University*	Changes in the properties of aerosols near marine stratocumulus	Talk	Aerosols not only affect droplet sizes and number concentrations in marine stratocumulus but in turn the moist cloud environment causes the aerosol particles to grow. In addition, the enhanced illumination of the cloud-free air in the vicinity of clouds leads to overestimates of aerosol optical depths and fine mode fractions and such trends have been reported for the MODIS aerosol products. Collocated MODIS and CALIPSO lidar observations were used to deduce the effects of the clouds on the scattering properties of nearby aerosols for large A-Train orbital segments over cloud-free oceans. The segments chosen for analysis were bounded either on both ends, or if sufficiently large (>100 km), on one end by extensive layers (> 25 km in length) of marine stratocumulus. The CALIPSO lidar returns were used to identify both the marine stratocumulus layers and the adjacent cloud-free oceans. The combined observations covered the global oceans, 60°S - 60°N, for a period of 2 years. The CALIPSO 5-km and MODIS 10-km aerosol optical depths both increase as marine stratus is approached. The variability in the MODIS aerosol optical depths is sufficiently small to discern that the increase grows exponentially as clouds are approached from a distance of 35 km. The distance for doubling the increase in aerosol optical depth is equivalent to the size of a MOD04 sample, 10 km. For large cloud-free oceans, in going from 35 km to within 5 km of the stratus the 10-km average aerosol optical depth increases by about 5%. This change is much smaller than that caused by increases in aerosol optical depth deduced for the higher relative humidity found in aircraft observations near clouds. The smaller change is due in part to the procedures employed in the MODIS processing which uses only the 500-m cloud-free MODIS pixels with reflectivities that are greater than the 25th percentile and smaller than the 75th percentile within each 10-km MOD04 sample to produce the aerosol properties. The changes derived using CALIPSO lidar returns are hampered by the noise of the detector which is further amplified through the optical depth retrievals. The associated 550/870 Ångström exponent deduced from the MODIS optical depths is consistent with larger particles near clouds, which in turn is consistent with the reduction in the fine mode fraction found near clouds. The changes are statistically significant at the 95% confidence level but only for the 10-km MOD04 samples adjacent the clouds. Owing to the variability in the CALIPSO optical depths, no statistically significant change in the 532/1064 Ångström exponent is found for the daytime observations and only that for the 5-km region adjacent the clouds is statistically significant for the nighttime observations. The change in the Ångström exponent for the nighttime observations suggests that the aerosol particles are larger adjacent to the cloud. Because they are restricted to the samples adjacent the clouds, as opposed to persisting for samples further from the clouds, the changes in both CALIPSO and MODIS aerosol optical depths could be caused by cloud contamination of observations identified as being cloud-free. The finding for the MODIS aerosol optical depths that particles appear to grow

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
31.	Mr. Jason Cole *Canadian Centre for Climate Modelling and Analysis*	Assessing simulated clouds and radiative fluxes using properties of clouds whose tops are exposed to space	Poster	A diagnostic study using co-incident top of atmosphere (TOA) radiative fluxes and cloud optical properties for clouds whose tops are exposed to space within several pressure ranges is presented, which tests a GCM's ability to simulate cloud properties and their radiative fluxes. As an example, the top of atmosphere radiation budget from Clouds and the Earth's Radiant Energy System (CERES) and cloud properties from the CERES Science team are used to assess the Canadian Centre for Climate Modelling and Analysis atmospheric global climate model (CanAM4). While the CanAM4's July-mean all-sky TOA shortwave and longwave fluxes agree well with those from CERES, the diagnostics reveal that these agreements rest on underlying compensating biases in simulated cloud properties and radiative fluxes. Most notably, low and middle cloud albedos simulated by CanAM4 are larger than those inferred by CERES which is attributed to CanAM4 simulating cloud optical depths, via large liquid water paths, that are too large for these clouds. These cloud albedo biases are then partly compensated by biases in cloud fraction. In addition, it was found that CanAM4 produces significantly different 2D histograms of cloud fraction and cloud albedo compared to CERES for low, middle and high clouds
32.	Dr. Steven Cooper *University of Utah*	Ice cloud vertical profile retrievals for SPartICus using combined CloudSat CALIPSO and MODIS observations	Poster	The recently completed Small Particles In Cirrus (SPartICus) field campaign provides an ideal means to characterize the properties of ice clouds. This program successfully completed numerous flights within cirrus clouds that provided co-located observations from both in-situ airborne instrumentation and the sensors of the A-Train constellation of satellites. This work exploits the unique SPartICus data set to perform multiple-sensor cloud profile retrievals of IWP, effective radius, and optical depth using the CloudSat cloud radar, CALISPO lidar, and passive radiance measurements from Aqua MODIS. Initial work focused on the development of a variational ice cloud retrieval scheme from the MODIS observations with results simply compared to those from the 2C-ICE combined CloudSat- CALIPSO operational product. The ultimate goal of this work, however, is to combine information from each of the lidar, radar, and passive radiance measurements into one variational cloud retrieval scheme, allowing a retrieved profile of cloud and precipitation properties (with uncertainties) consistent with all available measurements. The exact form of this scheme is a current topic of research. Results from these retrieval schemes are compared to airborne measurements from SPartICus for validation.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
33.	Dr. Celine Cornet *Laboratoire d'Optique Atmosphérique*	Global cloud optical thickness comparisons and studies from POLDER3/PARASOL and MODIS/AQUA.	Poster	Cloud optical thickness is a key parameter in the regulation of cloud radiative forcing. The correctness of its retrievals from satellites is important for climate studies and depends on many factors. We show in this study global cloud optical thickness derived from POLDER (Polarization and Directionality of the Earth Reflectance) and MODIS (MODerate resolution Imaging Spectroradiometer) and their differences, taking advantages of the combination of coincident data from the A-train and using high confident cloud cover and phase pixels. Thanks to the high resolution of MODIS and the 16 directional observations of POLDER, the comparison study is able to investigate the statistical bias of optical thickness due to the sensor spatial resolution, the cloud detection, the phase identification, the cloud microphysics and the cloud heterogeneity. High confident linear relationships exist between the optical thicknesses of the two sensors. These relationships are carefully studied according to different clouds and conditions to reveal the uncertainty of the retrievals. Plan-parallel errors are also assessed in the study according to different observation geometries, which supports the results of 3-D effects from simulations.
34.	Dr. Juan CUESTA *IPSL / LMD-LATMOS*	Seasonal evolution of transport of dust in the Saharan atmospheric boundary layer over West Africa, as described by multi-year CALIOP observations	Talk (Withdrawn)	The Sahara is the world's most significant source of mineral dust in the atmosphere and the characteristics of the atmosphere in this region play a significant role in the atmospheric global circulation. Significant dust uplift occurs in many regions as the Bodélé depression or the Western Sahara resulting from high windspeeds near the ground due to the downward mixing of momentum from the nocturnal low-level jet. Important quantities of dust may as well be uplifted by density currents generated by mesoscale convective systems near the Inter-Tropical discontinuity region associated to the northward progression of the West African monsoon (WAM). These mechanisms have been recently put in evidence and their relative importance is still unknown. The present work presents an overall description of the season evolution of the dust spatial distribution over West Africa using a multi-year database of CALIOP spaceborne lidar observations and ECMWF model analyses. It aims at identifying the main dynamical mechanisms controlling the dust 3D distribution and transport: diurnal vertical mixing, dynamical lifting, the link with the seasonal meridional progression of the WAM and influence of the African Easterly Jet in westward transport towards the Atlantic.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
35.	Dr. Anthony B Davis *Jet Propulsion Laboratory*	A Strategy for Unraveling Clouds and Aerosols in GLORY's APS Footprint	Poster (Withdrawn)	At the time of the Symposium, the Glory mission will be preparing for launch. If all goes according to plan, its main instrument, the Aerosol Polarimetry Sensor (APS), will soon be delivering aerosol properties that matter for climate with unprecedented accuracy: optical depth, fine-versus-coarse mode partition, moments of size distributions, non-sphericity, single-scattering albedo, possibly plume height, etc. This breakthrough is enabled by high-precision multi-spectral polarized radiance measurements and copious angular sampling over a footprint with dimensions varying from ~5 to ~20 km in scale. The APS will also target cloud properties, with its polarization capability opening wider a window on cloud particle sizes first used by POLDER. Together these retrievals will allow atmospheric scientists to investigate to new depths the interactions between clouds, aerosols and radiation in the climate system, particularly the feedback mechanisms that have so far eluded our understanding at the level required for proper representation in GCMs. At the core of the physics-based aerosol remote sensing algorithm is a "vector" radiative transfer (RT) code that predicts the APS signal at all wavelengths and polarizations for a given aerosol and molecular atmosphere. Since the code is one-dimensional (1D), the retrieval is expected to perform well only in the absence of clouds, particularly broken clouds. The APS is not an imaging detector but Glory will carry Cloud Cameras (CCs) at two wavelengths to screen such problematic cases. For completely cloudy scenes, the polarimetric cloud property retrieval scheme kicks in, again based on vector 1D RT, therefore again excluding broken cloud scenes. Yet, some of the most interesting interactions between clouds and aerosols, both radiatively and microphysically, occur where the 3D cumulus-type clouds are embedded in an aerosol layer. At the Symposium, we will present our approach to the problem of retrieving such clouds' properties and those of their aerosol environment, with a programmatically driven emphasis on the later. Specifically, we will address structurally complex cloud-and-aerosol cases using a suite of 3D vector RT models. An exact (but inefficient) one will be used to simulate APS and CC signals under realistic broken cloud conditions, where we know everything about the clouds and aerosols. A number of approximate (but fast) models will be developed to analyze APS and CC data when the latter warns us about the presence of broken clouds. A simple example of an approximate vector RT model is to combine linearly according to cloud fraction (as determined from CCs) the predicted radiances and polarization for the cloudy case and for the aerosol case. Possible synergies with other A-train sensors will be discussed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
36.	Dr. Julien M Delanoe *LATMOS (IPSL/UVSQ)*	Synergy of CloudSat and CALIPSO: An unprecedented tool for evaluating and improving GCM parametrizations	Talk	As GCMs become increasingly sophisticated, there is as strong a need as ever for evaluation with high quality observations to constrain and validate the parametrizations in the models, especially the evaluation of their vertical profile of cloud properties. In this paper we evaluate the operational UK Met Office model and the Numerical Weather Prediction models of the European Centre for Medium-Range Weather Forecasts (ECMWF) model with two versions of cloud parametrization, using observations from the active remote sensing instruments on-board the CloudSat and CALIPSO satellites in the A-Train constellation. Ice cloud properties are retrieved using the variational retrieval scheme of Delanoë and Hogan (2010) combining radar and lidar measurements. Its rigorous treatment of observational errors and careful use of additional constraints enables the retrieval to blend smoothly in the vertical between regions where different instruments are sensitive. This scheme allows one to retrieve ice cloud properties between regions of the cloud detected by both radar and lidar and regions detected by just one of these two instruments. We first present a comparison of this retrieval with the ice cloud properties derived from the standard CloudSat ice-only product, an empirical relationship relating ice water content (IWC) to radar reflectivity and temperature, and the standard MODIS retrieval. The retrieved ice cloud properties from our variational scheme are then used to evaluate the distribution of IWC and ice cloud fraction in the ECMWF and UK Met Office models. Using data from the last 3 weeks of July 2006, a global statistical comparison of the occurrence of grid-box mean IWC at different temperatures shows that both the mean IWC and the range of IWC increases with increasing temperature. Globally, the models capture most of the IWC variability in the temperature range between -60 ^{0}C and -5 ^{0}C. The models also reproduce the observed latitudinal dependencies in the IWC distribution due to different meteorological regimes. Two versions of the ECMWF model are assessed. The operational version with a diagnostic representation of precipitating snow and mixed-phase ice-cloud fails to represent the IWC distribution in the -20 ^{0}C to 0 ^{0}C range, but a new version with prognostic variables for liquid water, ice and snow is much closer to the observed distribution. The comparison of models and observations provides a much needed analysis of the vertical distribution of ice water content across the globe, highlighting the ability of the models to reproduce much of the observed variability, as well as the deficiencies where further improvements are required.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
37.	Dr. Min Deng *University of Wyoming*	Global Ice Cloud Properties From Combined Cloudsat and CALIPSO Data:	Poster	A profiling retrieval algorithm for ice cloud properties such as effective radius (re), ice water content (IWC) and extinction coefficient has been developed to use combined CloudSat and CALIPSO measurements based on an optimal estimation framework. Developed as an operational standard data product for the CloudSat project that will be known as 2C-ICE, the algorithm is designed to treat a wide range of ice cloud situations from optically tenuous cirrus in the upper troposphere to geometrically and optically thick anvil clouds. It is designed to consider the attenuation of thick clouds in the radar and lidar forward model equations and multiple scattering in the lidar data. An optimal estimation approach allows for inversion of the forward model equations so that the uncertainty due to the assumptions can be evaluated. A sensitivity study shows that lidar multiple scattering has to be accounted for carefully. As for all ice cloud retrieval algorithms, assumptions regarding particle habits and size distribution shapes are critical to the accuracy of the results. Uncertainties due to particle habits and size distribution assumptions are included in the forward model error covariance to analyze the retrieval error. The algorithm is applied to CloudSat/CALIPSO data and validated with in situ measurement during the TC4 mission on July 22 2007. Statistical comparisons of re, IWC, and optical depth with products created from other remote sensors in the A-Train will be explored.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
38.	Dr. Yevgeny Derimian *LOA, Universite de Lille1/CNRS*	Analysis of aerosol mixing state significance in remote sensing applications and radiative effect assessment	Poster	Most of the atmospheric remote sensing applications, including used for the A-Train data treatment, assume aerosol particles as homogeneous with size independent chemical composition. This assumption originates from the generally limited sensitivity of remote sensing observations to differences in aerosol structure and composition. However, in some situations, the variability of aerosol mixing state and composition can make significant influence on spectral, directional and polarimetric characteristics of solar radiations. The aim of this study is to identify the situations where aerosol heterogeneity produce distinct radiative effect and can be detectable by advanced remote sensing observations. In a series of numerical simulations we analyze manifestations of more complex aerosol structures in remote sensing observations. We also examine the limitations of conventional approach of using homogeneous particles with size independent chemical composition as a satisfactory radiative equivalent for retrievals from remote observations and for estimating aerosol radiative effect on climate. For example, AERONET retrieval processing relies on assumption of particle homogeneity. We identified and analyzed AERONET observations of possible mixture between biomass burning and mineral dust aerosols in the Sahel region. Examining these events we found that coating of dust by an absorbing material can reproduce the enhanced aerosol spectral absorption observed by AERONET. The aerosol radiative effect at the surface produced by this mixture was not a straightforward additive combination of dust and biomass burning components that is often used as suitable for modeling externally mixed components.
39.	Sergio G DeSouza-Machado *University of Maryland, Baltimore County*	Infrared retrievals of dust using AIRS : An intercomparison of optical depths and heights derived for a North African dust storm	Poster	Retrieved optical depths from instruments on the A-Train constellation are inter-compared for a February 2007 duststorm over the Sahara. AIRS thermal infrared radiance data are used with a fast infrared scattering radiative transfer model to physically retrieve the dust column amount and dust height over both ocean and land. Optical depths from AIRS correlate well with those from other instruments over ocean ($R > 0.9$), and are lower over land when compared to MODIS Deep Blue and OMI retrievals ($R < 0.8$). AIRS-derived dust top heights compare favorably with CALIPSO data, and can be used to improve OMI optical depth retrievals over a much larger area than CALIPSO can provide. We also compare retrievals of global dust layer heights using a synergy of AIRS and MODIS data from mid 2006-2009, against a CALIPSO aerosol height database.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
40.	Sergio G DeSouza-Machado *University of Maryland, Baltimore County*	Using AIRS, CALIPSO and CloudSat to study Deep Convective Clouds	Poster	Deep Convective Clouds (DCC) have been speculated to inject water vapor into the upper tropopause and lower stratosphere. We report ongoing work using data from NASA's hyperspectral Atmospheric Infrared Sounder (AIRS) to study processes when deep convection occurs. Daytime and nighttime frequencies of observations over land and ocean are reported. Possible relationships between retrieved cloud top height and stratospheric water vapor amounts and their spectral signature in the AIRS data will be explored. Retrieved cloudtop heights will be compared to CALIPSO and CloudSat data.
41.	Prof. Andrew Dessler *Texas A&M University*	A determination of the cloud feedback from climate variations over the last decade	Poster	The cloud feedback is responsible for a substantial part of the uncertainty in estimates of the Earth's climate sensitivity. Despite this, there have been few attempts to measure the magnitude of the global cloud feedback. Here we estimate the magnitude of the cloud feedback by analyzing CERES measurements of the variations in the top-of-atmosphere radiation budget over the period March 2000 to September 2009. Over this period, we see a positive cloud feedback with a magnitude of 1.09±0.86 (2σ) W/m^2/K. Our calculations show that the cloud feedback is dominated by a strongly positive longwave feedback, with a smaller positive shortwave feedback. Calculations of the cloud feedback in response to similar climate variations in climate models yield a similar feedback. The success of climate models in simulating the cloud feedback in response to these short-term climate variations should boost our confidence in the models' ability to simulate long-term climate change.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
42.	Dr. Abhay Devasthale *Swedish Meteorological and Hydrological Institute (SMHI)*	The vertical structure of the Arctic atmosphere observed from A-Train	Poster	The observed Arctic temperature increase over the 20th century is about twice as strong as the global mean. Currently available scenarios from almost all climate models point at the Arctic as the region with the largest foreseen temperature changes. Although several hypotheses have been proposed, there is still no consensus as to what mechanisms are responsible. Several poorly understood strong feedback mechanisms appear in the Arctic. Although the sea-ice albedo feedback is probably the most well known, recent studies point at several other factors of equal or larger importance. Climate model scenarios over the Arctic region show also a remarkable inter-model variability In these contexts, the Swedish Meteorological and Hydrological Institute (SMHI) in collaboration with the Department of Meteorology, Stockholm University (MISU), launched a new project in 2009 funded by the Swedish National Space Board (SNSB) to investigate the use of data products from A-Train satellites, CM-SAF and measurements from the ASCOS campaign to evaluate climate model simulations over the Arctic both at shorter and longer temporal scales. Here, we present first results whereby we investigate basic statistics of the vertical structure of the Arctic atmosphere using A-Train observations. The six years of AIRS data were used to analysed temperature structure, while CALIPSO 5km Aerosol and Cloud Layer Version 3 Products were used to investigate thin clouds and aerosols using four years of data. Additionally, the CloudSAT 2B-CWC-RVOD product was used to assess cloud liquid water content. Currently, the evaluations of Rossby Center regional model RCAO and global Earth system model EC-EARTH are ongoing.
43.	David Doelling *NASA-Langley*	The CERES diurnally complete radiative flux and cloud product	Poster	The Clouds and the Earth's Radiant Energy System (CERES) project has now surpassed the 10-year mark, has combined rigorous calibration, improved scene identification, and multi-satellite data fusion to produce a climate-accuracy data set of global 1° gridded radiative surface and TOA fluxes, and cloud properties. CERES provides the climate community with four observed TOA flux products. The SYN product uses GEO derived clouds and fluxes to provide diurnally complete TOA fluxes. This presentation will focus on the diurnal averaging improvements by the inclusion of imager radiances from 5 geostationary (GEO) satellites at 3-hourly intervals to estimate the flux in between CERES observations. The regional monthly mean flux differences based on SYN (CERES/GEO) and SSF (CERES-only) can exceed 20 Wm-2. Although the GEO based fluxes are of inferior quality then the CERES observed fluxes, they capture the diurnal signal more effectively than using constant meteorology between CERES measurements. The validation of the GEO derived fluxes and clouds will be shown.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
44.	David Doelling *NASA-Langley*	The new CERES level-3 product-ordering tool	Poster	The Clouds and the Earth's Radiant Energy System (CERES) project has now surpassed the 10-year mark, has combined rigorous calibration, improved scene identification, and multi-satellite data fusion to produce a climate-accuracy data set of global 1° gridded radiative surface and TOA fluxes, and cloud properties. CERES provides the climate community observed fluxes for climate model evaluation, by providing estimates of the annual global mean energy, meridianal heat transport, and cloud properties and profiles fluxes consistent with CERES observed TOA fluxes. As CERES algorithms were being developed, the official output products were written out in the same manner as they were processed. No thought was given to making the products user friendly. Users had very little information in choosing the appropriate product for their application and once they had the product hoping the parameter, time and spatial scale were what they anticipated. Currently the CERES team has implemented a new level 3 ordering tool designed with the user in mind. The ordering tool provides the user a summary of the products and processing levels with links for more information on the product parameters (with definitions), temporal and spatial scales, and availability. The ordering tool offers subsetting of parameters and user defined temporal and spatial resolutions. The user is given a choice of data formats, for example netCDF and ascii, as well as the traditional HDF. The ordering tool also provides browsing/plotting options to quickly determine if the ordered data is suitable for the users applications. The ordering tool, plotting package and associated web pages will be presented as well as hands on demonstration of the tool will be given.
45.	Dr. Xiquan Dong *University of North Dakota*	Validation of MODIS and Cloudsat Cloud Properties using ARM Ground-based Observations	Poster	Global satellite data are critical for both verifying and improving GCM cloud parameterizations for climate prediction, but their utility is limited without a reasonable estimate of the errors in the satellite-derived cloud properties. As part of the continuing effort to estimate uncertainties in satellite-retrieved cloud properties from NASA CERES project, this study compares the CloudSat/CALIPSO and CERES-MODIS cloud retrievals on Terra and Aqua flew over the DOE ARM SGP, NSA, and AMF-China (Oct-Dec. 2008). The ARM surface data were averaged over a 1-hour interval centered at the time of each satellite overpass, and the CERES-MODIS cloud properties were averaged in a 50-km x 50-km box centered on the ARM surface site. The cloud properties involved in this study include cloud-base and –top heights derived ARM radar-lidar and CloudSat/CALIPSO, effective cloud height derived from MODIS, vertical profile of cloud microphysical retrieved from ARM radar-radiometer and CloudSat/CALIPSO, and the layer-mean cloud microphysical properties retrieved from MODIS and ARM observations. To avoid the different assumptions in the ARM and CloudSat radar retrievals and different wavelengths, we also compare the radar reflectivities measured by ARM MMCR (35 GHz), WACR (94 GHz) and CloudSat radar (94 GHz) at the ARM SGP site.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
46.	Dr. Oleg Dubovik *LOA, Université de Lille1/CNRS, France*	Development of the approach for comprehensive retrieval of aerosol properties from enhanced satellite observations	Talk	The proposed development is an attempt to enhance aerosol retrieval by emphasizing statistical optimization in inversion of advanced satellite observations. The concept improves retrieval accuracy relying on pronounced data redundancy (excess of the measurements number over number of unknowns). The concept has been successfully adopted and refined in the operational AERONET algorithm retrieving the detailed aerosol properties from ground-based sun-photometer observations, however the required redundancy of observations is not common in satellites observations. Nonetheless, the observations by POLDER imager on board of the PARASOL micro-satellite registering spectral polarized reflected atmospheric radiation in up to 16 viewing directions over each observed pixel provide sufficient basis for applying the proposed methodology. Moreover, the observations by POLDER can be further enhanced by the synchronized observations of other satellite sensors of A-Train constellation, such as MODIS and CALIPSO. The retrieval scheme is designed as statistically optimized multi-variable fitting of complete observation set including both measurements of total radiances and polarized at all available spectral channels. Based on this strategy, the algorithm is driven by large number of unknowns and aimed on retrieval of extended set of parameters affecting measured radiation. This approach is expected to allow robust retrieval of both the optical properties of aerosol and underlying surface from satellite observations over ocean and land. Even over land, the algorithm provides more detailed (compare to current operational PARASOL algorithm) information about aerosol properties including some information about aerosol sizes, shape, absorption and composition (refractive index). In addition, the algorithm is developed as simultaneous inversion of a large group of pixels within one or several images. Such, multi-pixel retrieval regime takes advantage from known limitations on spatial and temporal variability in both aerosol and surfaces properties. Specifically the pixel-to-pixel or day-to-day variations of the retrieved parameters are enforced to be smooth by additional appropriately set a priori constraints. This concept is expected to provide retrieval of higher consistency for aerosol retrievals from satellites, because the retrieval over each single pixel will be benefiting from co-incident aerosol information from neighboring pixels, as well, from the information about surface reflectance (over land) obtained in preceding and consequent observation over the same pixels. It is should be noted that the approach considerably relies on the accumulated experience and many aspect of the retrieval, as well as, actual computer tools were inherited from precedent efforts on developing AERONET operational retrieval and currently operating PARASOL algorithm.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
47.	Dr. Philippe Dubuisson *Laboratoire d'Optique Atmosphérique*	Remote sensing of volcanic ash clouds from thermal infrared radiometry	Poster	Volcanic eruption in Iceland sent large plumes of ash into the atmosphere, with significant effects on air traffic. This study reports on the optical and microphysical characterization of particles contained in volcanic ash clouds using thermal infrared radiometry. Previous works have shown that the split window technique allows the estimation of the effective particle size and optical thickness of semi-transparent clouds from two channels in the infrared atmospheric window (8 - 12 μm). In this work, this method is applied to the characterization of particles contained in volcanic ash clouds. In a first step, a sensitivity study based on radiative transfer calculations is presented in order to evaluate the potential of this approach. An accurate radiative transfer code including gaseous absorption and multiple scattering is used as well as realistic spectral variations for optical properties of several types of volcanic particles (H2SO4, Ash, Dust …) and ice or water clouds. Gaseous absorption is obtained from the k-distribution approximation based on HITRAN2008. This technique is then applied to volcanic plumes in April-May 2010. MODIS and / or Infrared Imaging Radiometer (IIR) measurements at 8.6, 11 and 12 μm are used for some scenes acquired over North / West of Europe. The inversion algorithm is based on LUTs built with the radiative transfer code. Spatial distribution of the retrieved optical thickness, effective size and particle type are presented and analyzed. The contribution of the spectral channels to retrievals is also discussed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
48.	Elizabeth Dupont *University of Utah*	Investigating Cirrus Cloud Behavior Using A-Train and Geostationary Satellite Data	Poster	Knowledge of how large-scale dynamics are coupled with microphysical properties is necessary for parameterizing cirrus in climate models. In this study, the synergy of the CloudSat and CALIPSO instruments is exploited for identifying cirrus. Mesoscale-size cirrus events are defined using a combined CloudSat-CALIPSO cloud mask and temperature data from one year of data in the Atlantic basin. The cirrus events are sorted based on pressure- radar reflectivity patterns using a k-means clustering algorithm. The six clusters that are identified include deep cirrus, mixed cloud, high cirrus, thick cirrus with low cloud, thin cirrus with low cloud and single-layer cirrus. Using NCEP/NCAR reanalysis data, the composite dynamics for each cirrus cluster are created to determine the environments in which the cirrus clusters exist. We find that the average dynamic conditions differ considerably among the cirrus clusters. For example, Thick Cirrus with Low Cloud is typically associated with an upper-level ridge crest, while Deep Cirrus is often associated with a warm front at the surface. In order to characterize the tendencies of the cirrus events, the instantaneous view of A-Train satellites is augmented with the temporal view from geostationary satellite. Cirrus events are tracked in time using a tracking algorithm, which follows patterns of 6.2μm brightness temperature in consecutive water vapor images. If the average brightness temperature is decreasing (increasing) in time, then the cirrus is classified as growing (dissipating). To understand how the large-scale meteorology plays a role in the evolution of the cirrus events, the dynamics associated with the cirrus are investigated. In general, growing cirrus events are found in regions with more upper-level moisture and lift than dissipating events.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
49.	Dr. Nicolas Ferlay *Laboratoire d'Optique Atmospherique (LOA), Univ. Lille1*	First results following new inferences about cloud structure from POLDER3/PARASOL multiangular measurements in the oxygen A band : corrected cloud oxygen pressure and cloud geometrical thickness	Poster	We obtained recently evidences that multidirectional measurements in the oxygen A band from POLDER3/PARASOL can better help to characterize the vertical structure of cloudy atmospheres. From simulation of photon penetration within cloud layers, from simulation of POLDER measurements in the oxygen A band, we analyzed that, in the case of monolayer clouds, the standard POLDER cloud oxygen pressure product Po2 is sensitive in two ways to the cloud geometrical thickness H: (i) Po2 is on average close to the pressure MCP at the geometrical middle of the cloud layer ; (ii) the angular standard deviation \sigma_Po2 of Po2 is tightly correlated with H. We demonstrate here these sensitivities and correlations, show how the difference Po2-MCP can be further reduced, and the robustness of the correlation between \sigma_Po2 and H. We validate this approach at the global scale and over a long time period with collocated measurements from CALIPSO and CloudSat and their synergetic product 2B-GEOPROF-LIDAR that identifies the vertical location of cloud layers. We compare here the statistics of cloud presence in atmospheric columns coming from CALIPSO/CloudSat, the corrected POLDER oxygen-based pressure and geometrical thickness, and using cloud top pressure proxy, as POLDER Rayleigh or MODIS cloud top pressures.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
50.	Dr. Richard A Ferrare *NASA Langley Research Center*	Evaluating satellite measurements of aerosol types using airborne HSRL measurements	Poster	The NASA Langley Research Center (LaRC) airborne High Spectral Resolution Lidar (HSRL) on the NASA B200 aircraft has acquired extensive datasets of aerosol extinction (532 nm), optical thickness (532 nm), backscatter (532 and 1064 nm), and aerosol depolarization (532 and 1064 nm) profiles coincident with measurements from the Terra and A Train satellites. The HSRL measurements of aerosol intensive optical properties [i.e. aerosol depolarization (532, 1064), extinction/backscatter ratio ("lidar ratio") (532 nm), and backscatter color ratio (532/1064)], which provide qualitative information about the aerosol physical properties, have been used in a classification procedure to identify major aerosol types and apportion aerosol optical thickness among these aerosol types. This presentation describes how the aerosol types derived from the HSRL data have been used to help assess and interpret aerosol measurements acquired by the CALIPSO and MISR sensors. CALIPSO extinction and backscatter retrievals rely on an algorithm that attempts to identify and classify the aerosol type using surface type, layer altitude, integrated attenuated backscatter, and depolarization ratio. Comparisons of the aerosol types derived from the CALIOP measurements and simulated by the GOCART aerosol transport model have generally shown good agreement among major aerosol types. However, in some cases the CALIOP algorithm misclassifies the aerosol type which results in errors in the CALIOP aerosol extinction and optical thickness measurements. Therefore, the aerosol intensive parameters and aerosol types derived from the coincident airborne HSRL measurements have been used to assess the aerosol types derived from the CALIPSO measurements and simulated by GOCART. The HSRL measurements show that aerosol type often varies with altitude. Consequently, column average measurements of aerosol type derived from passive satellite (e.g. MODIS, MISR) and surface (e.g. AERONET) sensors often represent some mixture of aerosol types. Using the HSRL aerosol type analyses and the aerosol measurements derived from MISR, which provides some qualitative indication of aerosol size, absorption, and shape for the entire atmospheric column, we examine the impact of the vertical variability on the column retrievals of aerosol optical properties.
51.	Eric Fetzer *Jet Propulsion Laboratory*	An A-Train Water Vapor Data Climate Data Record Using Cloud Classification	Poster	We are creating a merged water vapor data record using measurements from sensors in NASA's A-Train satellite constellation. We are classifying water vapor sensors' scenes using collocated cloud observations. This allows characterization of changes in water vapor from observations with different noise characteristics, vertical resolution, and cloud-induced sampling. We describe results of analysis of this data set, and describe how it can be used to test weather and climate models.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
52.	Dr. Cyrille N Flamant *LATMOS - CNRS*	FENNEC: a project aiming at unveilling the Saharan climate system	Poster	The central Sahara has one of the most extreme climates on Earth. During the northern summer months, a large low pressure system caused by intense solar heating develops over a huge, largely uninhabited expanse of northern Mali, southern Algeria and eastern Mauritania. This Saharan heat low plays a pivotal role in the West African Monsoon. Moreover, the Saharan heat low region is dynamically coupled with the Mediterranean basin and the Sahel, two regions for which the predicted uncertainties associated with the impact of global forcing are quite significant. This large zone is also where the thickest layer of dust anywhere in the Earth˚s atmosphere is found. The direct and indirect effects associated with desert dust are still poorly quantified, and the biases and errors affecting the radiative budgets in models over the Sahara are very important. It is known that such errors in modelled dust radiatif effects lead to errors in key dynamical features beyond the Sahara, with consequences for tropical development in the Atlantic and the circulation over the Mediterranean basin. The failure of climate models or numerical prediction models to capture main features of the Saharan weather is related to (i) the paucity of available data in this region, (ii) the difficulty to retrieve reliable space-borne “aerosol” products over deserts, and (iii) a lack of knowledge regarding the dynamics, thermodynamics and radiative processes in the Saharan atmosphere. To date, there exist very sparse data sources in this region that can be used reliably to enhance knowledge in terms of mesoscale processes or model validation. Large uncertainties remain regarding the position of dust sources, the quantity and the properties of mineral dust emitted the albedo variability at the mesoscale and the impact of aerosol radiative forcing on the atmospheric dynamics in the region. Such uncertainties can only be thoroughly evaluated, and hopefully reduced, in the framework of an ambitious project aiming to make decisive progress in terms of dynamics, thermodynamics and on the structure and composition of the Saharan atmosphere, by means of observations over the Sahara. Based on this, the interested French, British and German communities have decided to propose the FENNEC project which aims at (i) characterizing the Saharan atmospheric boundary layer, (ii) evaluating its representation in regional and global models, and (iii) improving “aerosol” products issued from space-borne observations. A key element of this programme is the organization of an international field campaign in the Saharan heat low region, which will include both ground-based and airborne detachments in 2011.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
53.	Dr. Bertrand Fougnie *CNES (Centre National d'Etudes Spatiales)*	How Deep Convective Clouds are Used as a Reference Spectralon Plate on the PARASOL Calibration Processing	Poster	Deep Convective Clouds (DCC) are very convenient for calibration purposes. We will present how it is possible to use such natural targets in order to assess different aspects of the radiometric calibration for the PARASOL instrument. The way to select the best measurements will be described. In such conditions, DCC can be considered as a reference spectralon plate and consequently used for the interband calibration, as well as the multi-angular calibration (i.e. the calibration inside the field-of-view). DCC are also used to operationally monitor the temporal decrease of the radiometric sensitivity.
54.	Dr. Michael Fromm *Naval Research Lab*	Big Cloud No Cloud: Aerosol-polluted Ice Plumes In the UTLS	Talk	A recently discovered and peculiar form of ice cloud occupies the upper troposphere and lowermost stratosphere. These clouds can have a nearly synoptic-scale (e.g. ~1000 km) horizontal dimension and have the common characteristic that they are optically opaque at visible and thermal IR wavelengths yet are transparent to 94 gHz cloud radar. These clouds have been observed as the byproduct of pyrocumulonimbus storms, volcanic eruptions, and dust-entrained synoptic scale extratropical cyclones. Striking for their visible and IR optical depth, they are hypothesized to be comprised of an extraordinary cloud-particle number density of systematically small particle size compared to most cirrus clouds. Another curious and relevant observation pertaining to these clouds is a lifetime that exceeds, sometimes on the order of days, the norm for thunderstorm blowoff or cyclone cirrus shields. In this report we will present case studies illustrating the optical properties of these clouds, show the connection to the causal pyroconvection, volcanic injection, or dust storm, and follow the cloud lifecycle. Our analysis will combine satellite views from polar orbiting and geostationary nadir imagers, CloudSat space-based cloud radar, and CALIPSO lidar in space.
55.	Philippe Gamet *CNES*	Calibration of PARASOL over desert sites : cross-calibration with POLDER and MODIS sensors	Poster	Desert sites are used for many years to calibrate or cross-calibrate different sensors as well as monitor the temporal stability of the calibration. After a remind of the desert sites profiles and locations, the cross-calibration method will be presented, i.e. how measurements from the reference sensor are used to derive computed radiances to compare with measured radiances from the sensor to calibrate. We will present new results for the PARASOL instrument. POLDER2 will be used as a first reference to quantify the consistency between the PARASOL and POLDER2 calibrations which were elaborated through a nearly similar methodology. The MODIS-AQUA sensor will be used a second reference in order to draw the consistency between these two members of the so-called afternoon-train.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
56.	Mr. Michael J Garay *Raytheon*	Intercomparison of Cloud Top Height Retrievals from Instruments on Terra and the A-Train using Near-Coincident Observations	Poster	Cloud-top height is a fundamental climate parameter retrieved by a variety of instruments within NASA's Earth Observing System (EOS) constellation. Retrieval techniques vary from instrument to instrument and range from the stereophotogrammetric method employed by MISR on the Terra satellite, to the infrared techniques utilized by the MODIS instruments on both Terra and Aqua, to returns from radar and lidar backscatter used by Cloudsat and CALIOP, respectively. Due to their orbital configuration, where Terra crosses the equator at 10:30 a.m. local time on its descending node and Aqua crosses the equator at 1:30 p.m. on its ascending node, direct comparisons between Terra and A-Train instrument retrievals of cloud-top height are limited, primarily due to sampling and diurnal effects. However, this orbital configuration also leads to Terra/A-Train crossings with a time difference of only about 20 minutes in the polar regions around 69° N latitude. We will describe recent work that exploits these near-coincident observations to perform intercomparisons among the cloud-top height retrievals from the various EOS instruments. The polar region hosts a wide range of cloud regimes, and atmospheric and illumination conditions vary throughout the year, making observations of clouds in the polar region particularly challenging from space. However, relatively large statistical sampling and a common overhead perspective, compared to ground-based sites, provide a more consistent basis to deal with cloud overlap issues, for example. This intercomparison also provides a means to explore the different underlying physical principles employed by each of the instruments and the information content of the retrievals.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
57.	Dr. ANNE GARNIER *CNRS/IPSL*	Retrieval of cirrus cloud properties from combined IIR, Lidar and WFC observations of CALIPSO	Poster	The retrieval of cloud and aerosol radiative properties at the global scale is an important challenge for the understanding and survey of climate change. To this respect, upper level clouds are of particular importance due to their impact on the Earth radiation budget and their still poorly known microphysical characteristics. The split window technique has long been applied to space-borne passive thermal imagers observations to retrieve ice particles effective diameters in such clouds. This method has been improved in the frame of the NASA-CNES CALIPSO mission, by combining the CALIOP lidar vertical information, the Imaging Infrared Radiometer IIR measurements in three spectral bands (8.65, 10.6 and 12.05 µm) and the Wide Field Camera observations in the visible spectrum. Several cloud and aerosol CALIPSO products are obtained from the IIR: brightness temperatures, effective emissivities (Level 2a) and microphysics (Level 2b). Version 2 Level 2a IIR products are available at Langley ASDC and ICARE data Center since September 2008. Version 3 Level 2 products, based on the CALIOP Version 3 Level 2 products released in spring 2010, will be available by the end of the year and will include new parameters. The analysis performed in the operational algorithm is reminded here and first results obtained with version 3 are shown. This includes comparisons with in situ airborne observations performed during previous campaigns and comparisons with similar MODIS products.
58.	Dr. Timothy J Garrett *University of Utah*	Using passive remote sensing measurements from A-Train to validate in-situ measurements of ice crystal size	Talk	An important goal of co-ordinating aircraft in cirrus clouds with A-Train overpasses has been to validate space-based cloud retrievals, most particularly of ice crystal effective radius. Unfortunately, past efforts have had to be called into question, or even dismissed, due to valid concerns that in-situ measurements from aircraft might be plagued by ice particle shattering on instrument inlets, which might artificially bias the measurements of effective radii low. Of course, space-based measurements are unaffected by shattering concerns and so they might instead be used to "validate" the in-situ measurements themselves. In this spirit, we double-check prior in-situ measurements using a space-based infrared split-window technique that, while imprecise, provides an unambiguous assessment of whether thin cirrus clouds have effective radii smaller than about 20 microns, independent of a normal range of retrieval assumptions. Applied to MODIS data, we find that a very conservative minimum of 15-20% of thin cirrus globally with optical depths between roughly 0.5 and 3.0 are composed of small ice crystals, but that the actual value could be as high as 40%, and even higher for cold clouds or those in the tropics. Using the method to test the validity of prior in-situ measurements we find good agreement with airborne probe measurements from the CRYSTAL-FACE and SPartiCuS field campaigns, implying that, for the cases examined, the impact of inlet shattering on measurements must have been limited.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
59.	Dr. Jean - Francois Gayet *LaMP CNRS, Université Blaise Pascal*	Comparisons between CloudSat products and in situ observations. Part I : cirrus cloud characterization	Poster	In order to validate new space remote sensing observations numerous validation plans took place including in situ airborne measurements co-located with the satellite tracks. In this context, the ASTAR 2007 and POLARCAT 2008 airborne campaigns were carried out respectively in Arctic regions near Spitzbergen in April 2007 and in Northern part of Sweden in April 2008 to experience mixed-phase clouds. The CIRCLE2 campaign was carried out in Western Europe in May 2007 to sample mid-latitude cirrus clouds. The main objectives of these field projects were the characterization of microphysical and optical properties of mixed-phase and ice clouds with particular interest on the validation of clouds products derived from CloudSat and CALIPSO data during co-located remote and in situ observations. The airborne microphysical instruments included the Polar Nephelometer probe, the high resolution Cloud Particle Imager (CPI) and standard PMS 2D C and FSSP 100 instruments. The part I of the poster focuses on results obtained in cirrus clouds. They concern the comparison of the standard parameter of the Cloud Profiling Radar (CPR) of CloudSat (equivalent radar reflectivity factor Z) with the reflectivity factor deduced from quasi co-located cloud in situ measurements. The retrieved microphysical cloud parameters (IWC, Reff and particle concentration) from CloudSat algorithms are discussed with in situ observations. New parameterizations of cloud parameter relationships versus Z are then proposed from the dataset obtained in cirrus clouds.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
60.	Mr. Brian J Getzewich *NASA LaRC*	Comparison of CALIOP Data Merged Cloud Mask with Coincident CloudSat Measurements	Poster	A vertically resolved cloud mask has been constructed by merging together multiple Level 2 data products from the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instrument onboard CALIPSO. These products include the 333m and 5km cloud layer files and the 5km aerosol layer files. The development of such a cloud mask was driven by two goals. The first is to allow for the construction of detailed cloud climatologies based on the complimentary information contained in the full range of the CALIOP data products. One must account for all cloud layers detected (333m, 1km, 5km, 20km, and 80km), otherwise those features detected at multiple averaging (e.g. thin cirrus) may be disregarded. Incorporation of aerosols into the cloud mask accounts for the uncertainties and inabilities of differentiating clouds and aerosols, particularly at high latitudes. The second goal is to codify the basis for the development of a CALIOP Level 3 cloud product, in which cloud parameterizations are mapped onto a uniform time and space grid. The presentation will focus on the verification of the correctness (or deficiencies) of the filtering and merging criteria established to create these cloud mask files. This effort will take advantage of the nearly simultaneous vertical cloud observations made by CloudSat, using both the CloudSat CPR + CALIPSO Lidar Cloud mask (2B-GEOPROF-LIDAR) and the Cloud mask and radar reflectivity (2B-GEOPROF) products. Due to the nature of the instrumentation (lidar versus radar) one should expect differences between the two datasets (i.e. CloudSat cannot see optically thin clouds while CALIPSO has difficulty penetrating deep convection). But by quantifying these differences which occur in the vertical dimension, potential improvements could be added to the derived cloud mask.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
61.	Prof. Irina Gladkova *City College of New York*	A Multi-band statistical restoration of the Aqua 1.6 micron channel for the A-Train	Poster	The MODIS imager aboard Aqua is a critical sensor within the A-Train satellite constellation. Unfortunately, only 1/4 of the detectors is currently functional for the 500 meter band 6, the 1.6 micron channel. This channel is important in products for the analysis of aerosols, clouds and snow. These products are available from MODIS on Terra, but that sensor does not afford the unique temporal proximity with other members of the A-Train. Other related bands such as the 2.1 micron channel, Band 7, has been used as a proxy for aerosol and snow mask products to mitigate the band 6 problem caused by non-functional or noisy detectors. Although there is a well known strong correlation between bands 6 and 7, the fundamental problem with any approach that uses band 7 alone to determine band 6 is that, depending on different surface composition, these bands have distinctly different characteristics. Instead, we have developed an algorithm to restore Aqua band 6 using non-linear statistical regression to estimate the values of the missing data from the other 500 meter bands, as well as the data from the undamaged band 6 detectors. Damaged detectors, transmission errors, and electrical failure are all vexing but seemingly unavoidable problems leading to line drop and data loss. Standard interpolation can often provide an acceptable solution if the loss is sparse. Interpolation, however, introduces a-priori assumptions about the smoothness of the data. When the loss is significant, as it is on MODIS/Aqua, interpolation creates statistically or physically implausible image values and visible artifacts. Another approach is to use a related band, Band 7, to estimate the missing band 6 data via a lookup table. This assumes that there is a functional relationship between band 7 and band 6. The specific spectral reflective, absorptive, and scattering properties of individual atmospheric and surface constituents vary in a complex manner precluding any functional relationship between bands 6 and 7. We will show that by exploiting redundant information from multiple bands, we can obtain an accurate estimate of the missing band 6 information. The method uses values in a neighborhood of the pixel to be estimated and computes a value based on training data from the uncorrupted pixels. The increased accuracy from a multi-band statistical estimate of Aqua band 6 over using a band 7 proxy has significant consequences at the product level. As an example we will show that we can significantly improve the accuracy of the Aqua snow mask product by using our band 6 reconstruction, as compared to the currently used band 7 proxy. Since band 6 can also be important for estimation of aerosols and clouds, an accurate Aqua band 6 reconstruction could similarly provide accurate band-6 based aerosol and cloud products for comparison with other A-Train data.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
62.	Mr. Jonathan Gleason *NASA*	Processing Flow For Aqua and Terra Fused CERES Data Products	Poster	Clouds and the Earth's Radiant Energy System (CERES) is one of NASA's highest priority, Earth observing System (EOS) scientific instruments. CERES is a three-channel scanning radiometer that measures reflected sunlight and emitted radiation. The CERES science team integrates data from two CERES scanners on Aqua and two on Terra. Edition 2 CERES gridded data products merge CERES data from either Terra or Aqua with MODIS, geostationary and model data. CERES' approach for reprocessing the Edition 3 data record merges CERES data from both the Terra am and Aqua pm orbits to create level 3 gridded and averaged global data sets. In order to process years of the merged product, multiple instantaneous data sets are gridded into the CERES SFC one degree global data product. The SFC product contains one month of merged scanner data for a given spacecraft. Data are merged by selecting the scanner in cross track scanning mode. Next, monthly SFC files from each spacecraft are averaged to create the averaged global product. The resulting data sets are referred to as the SYN1deg data stream and include both observed top of atmosphere fluxes and computed fluxes at different altitude levels. This poster will discuss the processing flow required to produce the SYN1deg merged Terra and Aqua data sets from instantaneous CERES footprints.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
63.	Dr. Yves Govaerts *EUMETSAT*	Joint retrieval of Aerosol Properties and Surface Reflectance from Meteosat First, Second and Third Generation Observations with an Optimal Estimation Method	Poster	The Meteosat satellites play an important role for the generation of consistent long time series of aerosol properties. This importance relies on (i) the long duration of past (Meteosat First Generation, MFG), present (Meteosat Second Generation, MSG) and future (Meteosat Third Generation, MTG) missions and (ii) their frequent cycle of acquisition that can be used to document the anisotropy of the surface and therefore the lower boundary condition for aerosol retrieval over land surfaces. A similar approach is used for the processing of each Meteosat generation based on Optimal Estimation. Daily accumulation of the frequent Meteosat observations is used to discriminate the radiative effects that result from the surface anisotropy, from those caused by the aerosol scattering. The inverted forward model explicitly accounts for the surface anisotropy and the multiple scattering for the coupled surface-atmosphere system. The strength, expected results and issues of each Meteosat generation is discussed together with the algorithm applied to the various generations. Results are compared with those derived from A-train observations. Pinty et al. (2000) pioneered with the development of an original method to characterise simultaneously surface anisotropy and atmospheric scattering properties for the processing of MFG. Although these observations are limited to one single large VIS band poorly characterised, the main advantage of MFG relies in the duration of the archive (1982 – 2006), knowing that prior to 2000 space observations were very scarce. Despite these radiometric limitations, it is possible to detect major aerosol events like dust storms, fire plumes or pollution events, even over land surfaces. SEVIRI, on-board MSG, offers additional capabilities with its three solar channels and 15 min repeat cycle. AOD retrieval is much more accurate than with MFG and it is possible to discriminate among various aerosol classes. The additional FCI solar channels on-board MTG will offer improved capabilities with respect to MSG/SEVIRI for the retrieval of aerosol concentration and micro-physical properties. The FCI algorithm will benefit from several improvements to take full advantage of the enhanced radiometric performance of FCI: (i) a continuous variation of the state variables in the solution space, i.e, no more aerosol classes and (ii) the description of the aerosol refractive index spectral variations with a chemical mixture model composed of water-soluble (ammonium-sulphate), black carbon, iron and other insoluble components as quartz according to the method proposed by Schuster et al. (2009).

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
64.	Dr. Pawan Gupta *GEST/UMBC/GSFC/NASA*	Multi-sensor Satellite Remote Sensing of Dust Aerosols over North Africa during GERBILS	Poster	Satellite retrievals of aerosol optical depth (AOD) over high surface albedo regions such as the Saharan desert from is challenging and therefore limited. Several sensors on the A-Train series of satellites estimate aerosol information over land but are limited to only dark vegetated surfaces. A renewed focus on dust through field experiments and advances in satellite remote sensing are now enabling further research over North Africa. New algorithms have been developed to handle aerosol retrievals over these bright areas such as MODIS deepblue algorithm, which makes use of the blue channel to retrieve AOD over areas where MODIS operational algorithm does not work. Similarly, MISR (on Terra satellite) utilizes multiple view angle capabilities to retrieve AODs, and OMI retrieves AOD and aerosol index (AI) in ultraviolet part of electromagnetic spectrum. In this study, we will provide an overview of satellite remote sensing products over North Africa and examples from the Geostationary Earth Radiation Budget Inter-comparison of Longwave and Shortwave radiation (GERBILS) campaign during June 18-29, 2007. We will show comparisons of aerosol optical depth estimates from MODIS Deepblue algorithm, MISR, OMI, and SEVIRI with ground truth observations. Inter-comparisons among satellite sensors as function of surface albedo will also be presented. This is a step towards enhanced understanding of desert dust aerosols on the climate system whether or not differences exist among satellite algorithms.
65.	Dr. Ziad S Haddad *JPL*	Estimating precipitation using CloudSat and TRMM and/or extended-A-train radiometers	Poster	This contribution will describe the preliminary results of our efforts to combine the measurements from the CloudSat radar with MHS brightness temperatures, AIRS retrievals of temperature and moisture, AMSR-E estimates and/or TRMM measurements to derive improved estimates of precipitation.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
66.	Dr. Yuichiro Hagihara *Kyushu University*	A combined cloud mask algorithm using merged CloudSat and CALIPSO data: global cloud layer occurrence and cloud top height differences	Poster	We developed a cloud mask scheme for CALIPSO using a threshold of the attenuated total backscattering coefficient and a spatial continuity test. We then developed the combined CloudSat/CALIPSO cloud mask. The standard vertical feature mask (VFM) version 2.01 significantly overestimated low-level clouds. Below 2 km, the cloud fraction differed by as much as 25% between the VFM and our combined scheme. We also compared the zonal-mean cloud coverage by our CALIPSO scheme, the VFM, our combined CloudSat/CALIPSO scheme, and Aqua MODIS results. MODIS and our CloudSat/CALIPSO scheme gave similar results for low-level clouds in the tropics, but the VFM and our CALIPSO scheme differed by as much as 40%. The CALIPSO, CloudSat/CALIPSO, and MODIS results were similar for total cloud coverage, but the VFM result was different. Because of misclassification at low levels, the VFM showed the largest cloud coverage in the middle and low latitudes. We examined the differences in the cloud top heights (CTHs) detected by CloudSat and by CALIPSO. It has been generally accepted that CTHs detected by the CloudSat were lower than the CTHs detected by CALIPSO. However, theoretical studies suggested that CloudSat could detect cloud top part and CALIPSO could not detect it when cloud top portions consist of large particles with small number concentration and CloudSat-detetced CTHs could be higher than CALIPSO-detected CTHs. The clouds in which CloudSat-determined CTHs are larger than CALIPSO-determined ones turned out to be not rare unexpectedly, i.e., the global mean fractions were 22% and 35% in low- and middle levels and the corresponding CTH differences were 0.56 km and 0.85 km respectively.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
67.	Dr. Dorothy K Hall *NASA / Goddard Space Flight Center*	Snow Cover and Snowmelt Timing in the Wind River Range, Wyoming, 1970 – 2010	Poster	Earlier onset of springtime weather including earlier snowmelt has been documented in the western United States over at least the last 50 years. Because the majority (>70%) of the water supply in the western U.S. comes from snowmelt, analysis of the declining spring snowpack (and shrinking glaciers) has important implications for streamflow management. The focus of this work is the Wind River Range (WRR) in west-central Wyoming. Ten years of Moderate-Resolution Imaging Spectroradiometer (MODIS) snow-cover, cloud-gap-filled (CGF) map products and 30 years of stream discharge and meteorological station data are studied. Streamflow data from five streams in the WRR drainage basins show lower annual discharge and earlier snowmelt in the decade of the 2000s than in the previous three decades, though no trend of either lower streamflow or earlier snowmelt was observed within the decade of the 2000s. Results also show a statistically-significant trend at the 95% confidence level (or higher) of increasing weekly maximum air temperature (for three out of the five meteorological stations studied) in the decade of the 1970s, and also for the 40-year study period as a whole. The extent of snow cover (percent of basin covered) derived from the lowest elevation range (2500 – 3000 m) of the WRR, using MODIS CGF snow-cover maps, is strongly correlated with maximum monthly discharge on 30 April, where Spearman's Rank correlation, rs, = 0.89 for the decade of the 2000s. Observed changes in streamflow may be related to increasing weekly maximum air temperature measured during the 40-year study period, possibly contributing to a reduction in snow cover. The strong relationship between percent of basin covered by snow, and streamflow indicates that MODIS data are useful for predicting streamflow, leading to improved reservoir management.
68.	Ms. Seung-Hee Ham *Seoul National University*	Comparison of Cloud Properties Obtained from MODIS Visible and Infrared Observations	Poster	Cloud optical thicknesses are inferred from infrared Moderate Resolution imaging Spectroradiometer (MODIS) observations with an aid of Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) and Atmospheric Infrared Sounder (AIRS) measurements. Describing cloud vertical structures from CALIPSO data and atmospheric and surface properties from AIRS data, radiative simulations at infrared bands are performed under clear and opaque cloud conditions. Those theoretically estimated radiances are compared with observed MODIS radiances, from which cloud emissivity as well as optical thickness are inferred. Considering that visible-channel algorithm is sensitive to scattering phase function, whereas infrared-channel algorithm is not, comparison of retrieved results from two algorithms can give information about impact of scattering properties in cloud retrieval algorithm.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
69.	Dr. Tristan Harmel *City College of New York*	Long Island Sound Site for Ocean Color Validation in Coastal Water Coupled with Polarized Measurements	Poster	The Long Island Sound Coastal Observational platform (LISCO) near Northport, New York, has been recently established to support satellite data validation. LISCO is equipped with both multispectral SeaPRISM and hyperspectral HyperSAS radiometers for ocean color measurements. Customized hyperspectral radiometers have been added to the latter, enabling measurements of the polarization state (Stokes vector) of the water-leaving radiance. This offers an important potential to enhance the calibration and validation activities of current and future Ocean Color satellite missions, as well as satellite intercomparison for coastal waters area. LISCO will also expand observational capabilities for the continuous monitoring and assessment of the polarized properties of coastal waters. Results of measurements made by the LISCO instrumentation, in operation since October 2009, are presented, evaluated and compared with ocean color satellite data. This comparison of the normalized water-leaving radiance derived from SeaPRISM and from MERIS, MODIS and SeaWiFS showed satisfactory correlations (r>0.9 at 550nm) and consistencies (APD<15% at 550nm). In addition, equivalent results are obtained when the hyperspectral HYPERSAS data are compared with the same satellite datasets. This makes it possible to contemplate the wide use of the LISCO site to monitor current and future ocean color multispectral (VIIRS, Sentinel…) and hyperspectral (HICO) satellite missions. Furthermore, the validity of polarized measurements from the LISCO site has been demonstrated. That enables it to provide continuous polarized data time series for the validation of current and future polarization based missions such as PARASOL and Glory, as well as to assess the importance of polarization to retrieve the coastal water composition.
70.	Min He *Stevens Institute of Technology*	Estimation of Sea Surface Wind Speed and Aerosol Optical Depth from CALIPSO Measurements in Daytime	Poster	Using the collocated CALIPSO backscatter profile data and PARASOL AOD data, the relationship between the CALIPSO backscatter profile and PARASOL AOD is established over the Jan. 2007 observation. Applying this relation, we get a reasonable, unbiased estimation of the AOD using CALIPSO layer integrated lidar backscatter, with rms errors 0.072 for 532 nm and 0.049 for 1064 nm compared to the PARASOL observation, and hereafter the atmospheric transmittance which is used to remove the atmospheric attenuation to the sea surface backscatter. The collocated CALIPSO backscatter data and AMSR-E sea surface wind speed data are used for investigating the relation between the wave slope variance derived from the surface returned lidar signal and daytime sea surface wind speed from AMSR-E under different aerosol loading. The daytime wave slope variance / wind speed relation is slightly different from the one for the nightime. The difference is likely due to differences in boundary layer condition. Applying the fitting relations we got the estimation of sea surface wind speed which has rms error of 1.16m/s in agreeing with AMSR-E sea surface wind speed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
71.	Dr. Georg C Heygster *Institute of Environmental Physics, University of Bremen, Germany*	Estimation of cloud liquid water over sea ice from A-train sensors CloudSat and MODIS	Poster	Arctic cloud strongly influences the regional radiation balance, temperature and melt and freeze of sea ice in the Arctic, where global warming is most pronounced.. In contrast to their importance, there is a lack of quantitative and reliable observations of Arctic cloud. The A-Train sensors CPR (Cloud Profiling Radar) on CloudSat and MODIS (MODerate resolution Imaging Spectrometer) on Aqua offer products of one of the key parameters, cloud Liquid Water Path (LWP). However their quality over sea ice has not attained much interest until now. One reason may be the lack of reliable validation data. This situation has been improved with the recent cruise ASCOS (Arctic Summer Cloud Ocean Study) cruise of the research vessel Oden in August and September 2008 in the context of the International Polar Year. The ship carried a comprehensive suite of instruments for atmospheric observations, among them a microwave radiometer measuring the LWP practically during the whole campaign. Because CloudSat is observing along track only, among the 45 days of the ASCOS cruise investigation, only on 9 days colocations of CloudSat and Oden LWPs nearer than 3 h and 100 km were found, and only 2 days with collocations nearer than 1 h and 30 km. The little correlations of the scatterplots of both LWP retrievals can be explained with the patchiness of the cloud cover of these two days (Aug. 5th and Sep. 7th), as confirmed by coincident MODIS images. The averages of Oden observation LWP values are systematically higher (40 g/m2 – 70 g/m2) than the corresponding CloudSat observations (0 g/m2 - 50 g/m2). As these are cases of generally low LWP with presumably small droplets, the discrepancy may be explained by the little sensitivity of the CPR to small droplets. The cross-track scanning instrument MODIS yields much better colocations (1 min and 1 km). Comparisons of the Oden LWPs with those of MODIS over open water and sea ice are underway.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
72.	Dr. Andrew J Heymsfield *NCAR*	Evaluation of MODIS effective radii for ice clouds using collocated observations	Poster	Evaluation of MODIS effective radii for ice clouds using collocated observations Our in-situ observations in ice clouds point to effective radii that are of sizes 40-60 microns rather than 20-30 microns as is often found from passive remote sensing observations in ice clouds. In an attempt to document the magnitude of the discrepancy and the reasons for it, we use in-situ and remote sensing data measured during the TC4 field campaign based from San Jose, Costa Rica in 2006. In-situ observations, from the NASA DC-8 aircraft, included particle size distributions from 10's of microns to cm size and bulk measurements of the ice water content and extinction. Remote sensing measurements, from the NASA ER-2 aircraft, included radar and lidar measurements each at two wavelengths. MODIS Airborne Simulator (MAS) and MODIS/ASTER Airborne Simulator (MASTER) data from which effective radii were derived using the standard MODIS ice cloud retrieval algorithms. Extensive periods of collocated in-situ and remote sensing data were obtained on three days. We first evaluate extinction and ice water content derived from the remote sensing observations using the in-situ data. Using validated data, we develop algorithms to retrieve ice water content (IWC) from the radar measurements and extinction from the lidar measurements. We then derive cloud optical depth, and effective radii from the ratio of the IWC to extinction and on this basis evaluate the MODIS effective radii. It is demonstrated that MODIS effective radii are underestimated by about factor of two. We suggest possible factor responsible for these underestimates.
73.	Mr. Kyle Hilburn *Remote Sensing Systems*	Description of Remote Sensing Systems Version-7 Microwave Radiometer Processing	Poster	In 2010, Remote Sensing Systems completed a major update to its geophysical data products. Version-7 brings an unprecedented level of consistency to satellite retrievals of sea surface temperature, surface wind speed, columnar water vapor, columnar cloud liquid water, and surface rain rate over the ocean from the following passive microwave radiometers: SSM/I, SSMIS, WindSat, AMSR-E, and TMI. We will describe the changes made to instrument calibration, radiative transfer modeling, and retrieval methodology in Version-7; and show how these changes impact Version-7 retrievals relative to Version-6 retrievals. Water vapor has increased about 2% for vapor values above 50 mm, and the new vapor retrievals are in better agreement with GPS observations. The clear-sky bias in cloud water has been removed. Changes were made to the implementation of the beamfilling correction in the rain algorithm, which increased mean rain rates in the extratropics. Multi-decadal trends in vapor have not changed in Version-7. Trends in wind, cloud, and vapor have changed slightly. The causes of multi-decadal trend changes will be discussed. There is a minor change to the data format that we will describe – additional bins have been added to the low end of cloud water.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
74.	Brent N Holben *NASA/GSFC*	New AERONET developments for A-TRAIN science	Poster	AERONET evolved with the EOS program and continues so with A-Train. During the formative years of the early 1990s, a few ground-based sun photometer sites provided AOD and crude approximations of particle size distribution. By the second decade and the inception of A-Train, AERONET, profiting from significant international collaboration including PHOTONS based In Lille, resulted in globally distributed sites and greatly improved retrievals of aerosol properties for satellite and model validation. The current generation of A-Train sensors and analysis requires improved ground-based measurement approaches and near real time quality assured data analysis. A series of field campaigns called Distributed Regional Aerosol Gridded Observation Networks, (DRAGON) and a new validation product called Level 1.5V will facilitate assimilation models and new satellite validations. The temporary DRAGON networks are designed around gridded 10 X 10 km cells to more accurately characterize the 2-D and, with supplemental lidar and airborne participation, 3-D aerosol fields through time. These networks will be located in unique aerosol regimes coincident with in situ and RS observations where possible and appropriately positioned along the A-Train tracks. Occasionally current or near-real time data are required for comparison, validation or assimilation purposes. A new level 1.5v (validation) product is planned to provide AOD and retrieval products that pass restrictive filter controls eliminating compromised data that currently passes the standard level 1.5 cloud screened product. Both the DRAGON campaigns and level 1.5v data products will be discussed in this poster.
75.	Robert Holz *UW Madison SSEC*	Investigating differences between cirrus optical depth retrievals between V3 CALIOP and MODIS observations	Talk	The retrieval of cloud optical thickness (OD) is a critical property required to characterize the radiative impact of clouds on the earth's energy balance but has proven one of the more difficult properties to measure accurately. With the launch of CALIPSO in 2006, simultaneous active (CALIOP) and passive (MODIS) cloud OD is provided as part of the A-Train observations. A comparison between these retrievals finds significant systematic differences for single layer thin ice clouds (visible optical depth < 3). Explanations for these differences are many, ranging from algorithm implementation to differences resulting from the physical assumption built into the MODIS and CALIOP OD retrieval methods. This paper will investigate physical explanation for the OD biases between CALIOP and MODIS.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
76.	Prof. Robert Houze *University of Washington*	Combining Three A-Train Sensors to Better Understand the Role of Mesoscale Convective Systems in the Tropical Atmosphere	Talk	Mesoscale Convective Systems (MCSs) play important roles in the moisture budget and the diabatic heating structure of the Tropics. They greatly modulate the latent heating profiles because they not only contribute a large portion of total precipitation but also produce significant amount of stratiform rain, which tends to make heating profiles maximize in the upper troposphere. In addition, they inject large amounts of ice particles into the upper-troposphere to form extensive anvil clouds. The anvil clouds in turn affect the radiative heating structure of the troposphere, and when they evaporate they affect the humidity at upper levels. These impacts on heating and moisture distributions are crucial to the large-scale circulation and cloud and water vapor feedbacks. However, in contrast to the latent heating effect of MCSs, which has been extensively investigated in relation to precipitating storm data provided by the TRMM satellite and various tropical field projects, the non-raining MCS anvil clouds and their impacts on the moisture budget and radiative heating structure are as yet relatively poorly understood. The A-Train satellite formation has provided observations to overcome this knowledge gap. In this study, we jointly analyze three A-Train datasets (from MODIS, AMSR-E, and CloudSat) to identify the large anvil clouds of MCSs and investigate their structure. This task cannot be accomplished by simple pixel mapping of data. First, an algorithm must be devised to identify each contiguous cloud system that constitutes an MCS. Further analysis is then applied to each identified MCS object. We have developed an objective method based on MODIS and AMSR-E products to first determine if the cloud top size and coldness (based on MODIS measurements) and the rain area size and intensity (based on co-located AMSR-E data) satisfy a definition that is consistent with the literature on MCSs. These two co-located sensors further give us the ability to separate the non-raining anvil clouds from their raining centers. The algorithm is therefore extended to subdivide each MCS object into its raining and anvil portions. Using this algorithm-derived information, the database is subdivided into two important different subtypes of MCSs: separated MCSs (SMCSs) and connected MCSs (CMCSs). The latter are those MCSs that share a contiguous rain area. Mapping of the objectively identified MCSs shows patterns of MCSs that are consistent with previous studies of tropical convection, with separated MCSs dominant over Africa and the Amazon regions and connected (clustering) MCSs favored over the warm pool of the Indian and West Pacific Oceans. Based on this Aqua-orbited MCS database, measurements of MCSs from all A-Train components can be delineated into a system-by-system, as opposed to simple pixel-mapping, point of view. Data from different satellites can then be used together to obtain comprehensive information about the MCS phenomena. This is especially useful for sensors working in the "slicing" mode (i.e. taking a thin "curtain" of the atmosphere like CloudSat and CALIPSO). This curtain of information, when superposed on the AMSR-E and MODIS MCS entities in our database, then gives a vertical cross section across an MCS.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
77.	Dr. Jingfeng Huang *UMBC/GEST, NASA/GSFC*	Joint Use of CALIPSO and Aqua-MODIS for Studies on Contamination and Screening of Thin Cirrus Clouds in MODIS Aerosol Retrievals	Poster	Cirrus clouds, particularly subvisible thin cirrus at high altitudes, are difficult to be screened out in the operational aerosol retrieval algorithms. As part of A-Train constellation along with the Aqua Moderate Resolution Imaging Spectroradiometer (MODIS), the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) provides us unprecedented opportunities to examine whether the MODIS aerosol products are susceptible to cirrus contamination and to evaluate the robustness of various MODIS-derived cirrus screening techniques. Thin cirrus occurrence frequency was calculated based upon CALIPSO vertical feature mask. Quantitative statistical analyses for collocated MODIS-CALIPSO data indicate that the current operational MODIS aerosol retrieval is susceptible to cirrus contamination with strong spatial and seasonal variability, particularly over cirrus prevailing regions. Results also show significant linkage between cirrus occurrence frequency and the susceptibility of the MODIS aerosol optical thickness (AOT) data to cirrus contamination. Relatively larger MODIS AOT, smaller angstrom exponent and smaller fine mode fraction were reported when coincident cirrus clouds were observed by CALIPSO. We also examined the effectiveness and robustness of 8 MODIS-derived cirrus-screening parameters, including apparent reflectance at 1.38μm (R1.38), cirrus reflectance at 0.66μm (CR0.66), CR0.66 cirrus flag, reflectance ratio between 1.38μm and 0.66μm (RR1.38/0.66), reflectance ratio between 1.38μm and 1.24μm (RR1.38/1.24), brightness temperature difference between 8.6μm and 11μm (BTD8.6-11), brightness temperature difference between 11μm and 12μm (BTD11-12), and cloud phase infrared approach (CPIR), by comparing them with CALIPSO cirrus identification. As a result, the reflectance ratio of 1.38μm and 0.66μm (RR1.38/0.66) achieves best overall performance, followed by brightness temperature difference between 11μm and 12μm (BTD11-12). The results for several example cases presented in this study suggest that cirrus-screening modules in the operational MODIS aerosol retrieval algorithms should be improved to reduce any interference of cloud contamination due to subvisible cirrus.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
78.	Prof. Xianglei Huang *University of Michigan*	Synergy of CERES and AIRS in the study of band-by-band radiation budgets and cloud radiative forcings	Poster	Since mid 1980s, observed top-of-atmosphere(TOA) broadband radiant fluxes and cloud radiative forcings (CRFs) have served the climate community as standard datasets for evaluating GCM simulations and studying cloud feedbacks. Though, a major consequence using this approach is that compensating biases from different spectral bands could make the understanding of the broadband deficiencies difficult. Radiant fluxes and CRFs over each individual absorption band (hereafter termed as band-by-band radiation fluxes and CRFs) are what climate models directly compute, and therefore, comparisons of such quantities largely avoid the dilemma. Moreover, a unique characteristic of such band-by-band longwave CRFs is that the fractional contribution of each band to the broadband CRF is sensitive to cloud top height, but largely insensitive to cloud fraction. We here present a study of deriving the TOA band-by-band fluxes and CRFs over each individual longwave absorption band from collocated CERES and AIRS radiances observations over the tropical oceans, in a manner consistent with how the broadband OLR has been derived from CERES radiance measurements. Then, using the GFDL AM2 model and NASA GEOS-5 as case studies, we will illustrate the merit of band-by-band fluxes and CRFs that we derived from this algorithm in GCM diagnostics and in the study of cloud feedback. By comparing the observed band-by-band fluxes and simulated ones for the year of 2004, compensating errors in the simulated OLR from different absorption bands are clearly revealed. Though the broadband fluxes and CRFs simulated by AM2 and GEOS-5 agree with each other quite well, their band-by-band breakdowns are indeed very different and can be attributed to different biases in underlying physical processes in each GCM. The case study here corroborates the merit of band-by-band fluxes and CRFs: they are valuable additions to the much-needed orchestrated studies of climate modeling and cloud feedbacks.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
79.	Dr. Thomas J Jackson *USDA Hydrology and Remote Sensing Lab*	Soil Moisture Product Validation of AMSR-E 2002-2009	Poster	Four soil moisture networks were developed and used as part of the Advance Microwave Scanning Radiometer-Earth Observing System (AMSR-E) validation program. Each network is located in a different climatic region of the U.S., and each provides estimates of the average soil moisture over highly instrumented experimental watersheds and surrounding areas that approximate the size of the AMSR-E footprint. Soil moisture measurements have been made since the launch of AMSR-E and provide seven year period of record, 2002-2009. The NASA and JAXA standard soil moisture products were compared to the network observations; along with two alternative soil moisture products developed using the single channel algorithm (SCA) and land parameter retrieval model (LPRM). The metric used for validation is the root mean square error (RMSE) of the soil moisture estimate as compared to the in situ data. The mission requirement for accuracy defined by the space agencies is 0.06 m3/m3. The statistical results indicate that each algorithm performs differently with respect to each site. Neither the NASA nor JAXA standard products provide reliable estimates for all the conditions represented by the four watershed sites. When site specific corrections were applied, all algorithms had approximately the same level error and correlation. These results clearly show that there is much room for improvement in the algorithms currently in use by JAXA and NASA. They also illustrate the potential pitfalls in using the products without a careful evaluation.
80.	Eric Jensen *NASA Aems*	Using HIRDLS and airborne lidar measurements to investigate low-extinction cirrus (not detected by CALIPSO) that form near the tropical cold-point tropopause	Poster	Lidar measurements from the NASA ER-2 on past field campaigns (CEPEX, TOGA COARE, and TC4) indicate the presence of very low extinction (<0.005 km^-1) cirrus near the cold-point tropopause. These clouds are too optically thin for detection from space-based lidar (CALIPSO). In the TC4 CPL lidar dataset, these thin clouds typically occur at 17.5-18 km, which is above the mean thermal tropopause. They are likely associated with large temperature excursions caused by gravity waves (readily apparent in the TC4 soundings). The low extinctions are expected given the limited avaialbility of water for condensation at these low temperatures. Although these thin cirrus likely have negligible impact on the radiation budget, they can be important for dehydration of air entering the stratosphere because they form at the extreme minimum temperatures. Limb viewing satellite observations such as SAGE, HALOE and HIRDLS can detect optically thin cirrus cirrus that are below the CALIPSO detection threshold. We will present statistics of these optically thin, high altitude tropical cirrus based on the airborne lidar measurements as well as HIRDLS measurements. In addition, we will use trajectory-based microphysical simulations to evaluate the importance of these clouds for regulation of stratospheric humidity. We will briefly discuss the NASA ATTREX mission that will provide extensive airborne lidar measurements across the Pacific.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
81.	Dr. Jonathan H Jiang *Jet Propulsion Laboratory*	Utilizing NASA A-Train datasets to evaluate global models	Talk	Using collocated A-Train measurements, we evaluated clouds and water vapor simulations from GEOS5-AGCM, NCAR-CAM3.5 and GDFL-AM2. To ensure consistent spatial and temporal sampling between model output and satellite measurements, 3-hourly (or 6-hourly) model outputs were interpolated onto satellite measurement locations in both space and time and with vertical averaging kernels applied. Two types of comparison were performed in this model evaluation study: Direct Comparison examines model consistency with satellite observations in terms of the global distribution, seasonal maps, tropical mean profiles, day-night difference, latitude-time section, height-time section, longitude-time section, and the response to ENSO; Conditional Sampling sorts modeled and observed parameters by large-scale meteorological variables to examine the relationships of cloud and water vapor with environmental conditions. Our analysis demonstrates the strength and weakness in model representation of clouds and moisture, and indicates possible areas of improvements.
82.	Prof. Menglin Jin *San Jose State University*	Using MODIS Land and Atmosphere Observations with the WRF Model to Understand Urbanization Impacts on Water and Heat Cycles	Poster	Urbanization is an extreme case of land cover change. Studying urbanization effects using NASA A-train MODIS observations sheds light on human-induced modifications of local, regional, or even global weather and climate. MODIS land and atmosphere data have been used in two ways: first, direct analysis of the data to reveal the signal and in particular magnitude of urban effects; and second, improvement of the representation of urban regions in land surface models coupled to global and regional climate models. For example, the Urban Heat Island effect (UHI) is examined from selected cities to global scale. The UHI refers to urban skin or air temperature exceeding the temperatures in surrounding non-urban regions. In a warming climate, the UHI may intensify extreme heat waves and consequently cause significant health and energy problems. Therefore, reducing urban surface temperature is critical. Aerosols reduce surface insolation via the direct effect, namely, scattering and absorbing sunlight in the atmosphere. Combining the National Aeronautics and Space Administration (NASA) AERONET (AErosol RObotic NETwork) observations over large cities with Weather Research and Forecasting Model (WRF) simulations, we find that the aerosol direct reduction of surface insolation ranges from 40-100 Wm-2, depending on seasonality and aerosol loads. As a result, surface skin temperature can be reduced by 1-2ºC while 2-m surface air temperature reductions were generally on the order of 0.5-1°C. This study suggests that the aerosol direct effect is a competing mechanism for the urban heat island effect (UHI). More importantly, both aerosol and urban land cover effects must be adequately represented in meteorological and climate modeling systems in order to properly characterize urban surface energy budgets and UHI. In addition to UHI, MODIS data also reveal possible aerosol-cloud-precipitation relationships.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
83.	Dr. Benjamin T Johnson *UMBC/JCET and NASA/GSFC 613.1*	Physically-Based Snowfall Retrievals Using CloudSat Radar Reflectivities	Poster	Physically-Based Snowfall Retrievals Using CloudSat Radar Reflectivities Benjamin T. Johnson1,2, Gail Skofronick-Jackson1 1Mesoscale Processes Branch, Code 613.1, NASA Goddard Space Flight Center, Greenbelt, MD Benjamin.T.Johnson@nasa.gov 2University of Maryland Baltimore County, Joint Center for Earth Systems Technology Abstract for A-Train Meeting, October 2010 Prefer POSTER presentation, in same session as “Passive Microwave Retrievals of Falling Snow over C3VP as Compared to CloudSat” (G.S. Jackson) One of the primary difficulties in measuring snowing clouds using remote sensing technologies is the sensitivity to the snow itself, rather than the various other geophysical properties of the atmosphere, clouds, and surface. Passive microwave observations at sufficiently small wavelengths (on the order of millimeters, e.g., AMSU-B, SSMI/S) are sensitive to scattering and emission from snow clouds, but suffer from relatively low spatial resolution and a lack of vertical sensitivity. Satellite based active radar is presently the ideal platform for monitoring and measuring snowfall on a nearly global basis. The CloudSat Profiling Radar (CPR), operating near 94 GHz (~3.19 mm wavelength) is optimal for observing light to moderate snowfall. In heavy snowfall, the radar signal suffers from potentially strong path integrated attenuation (PIA) and multiple-scattering. The present research describes an ongoing effort to develop a database of ice-phase precipitation particle physical properties and associated radar/radiometric properties for use in physically-based snowfall retrievals. The primary source of information for the database comes from ice water content (IWC) values obtained from the WRF cloud resolving model cases (courtesy of W.K. Tao, J.J. Shi, et al.). We distribute these IWC values at each vertical level of the model (30 m resolution) according to published particle size distribution (PSD) models for snowfall, and employ various realistic-shape models to populate the database with a wide range of particle properties so that more robust retrievals may be possible. These physical properties are fed into a forward radiative transfer model developed by the primary author to compute vertical profiles of radar reflectivities at Ku, Ka, and W-bands. The complete database will consist of vertical profiles of IWC, associated PSD parameters at each level (e.g., N0, D0) for various hydrometeor shapes, cloud properties, surface properties (for computing the NRCS of the surface), and other atmospheric parameters which influence attenuation of the radar signal. Coincident with these parameters are the unattenuated radar reflectivities at Ku, Ka, and W bands. We also introduce a new Bayesian retrieval algorithm for matching observed CPR radar reflectivity profiles with attenuated radar reflectivity profiles derived from the database. The effects of multiple scattering are being examined currently, and we intend to incorporate this in our final retrieval product.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
84.	Dr. Joanna Joiner *NASA Goddard Space Flight Center*	The optical centroid pressure: Lessons learned from and applications enabled by the A-train	Poster	The launch of several active and passive sensors into the A-train that measure cloud properties has produced a paradigm shift. The solar backscatter trace-gas retrieval community now understands that backscattered sunlight penetrates clouds more deeply than originally thought. There are two ways to estimate the photon path of backscattered sunlight with the Aura Ozone Monitoring Instrument (OMI). One method uses the effects of rotational-Raman scattering in the ultraviolet and the other uses absorption from the oxygen dimer at 477 nm. The photon-path is expressed in terms of a quantity that we call the optical centroid pressure. Using CloudSat and MODIS data, we were able to quantitatively validate retrieved optical centroid pressures for the first time. Several applications of the OMI optical centroid retrievals will be discussed including some enabled by combining these retrievals with other cloud products from Aqua MODIS: 1) improved retrievals of tropospheric ozone concentrations including those inside deep convective clouds 2) accurate estimates of the global radiative effect of tropospheric ozone and nitrogen dioxide 3) detection of multi-layer clouds 4) estimates of the cloud shielding effect over snow and ice 5) evaluation of cloud vertical structure in general circulation models.
85.	Mr. Jason B Jones *NASA DEVELOP Program*	NASA Earth Observations Track the Gulf Oil Spill	Poster	On April 20, 2010, an explosion aboard the Deepwater Horizon drilling rig in the Gulf of Mexico began one of the worst oil spill disasters in U.S. history. As the U.S. government established a unified command for responding to the spill, some of its most immediate needs were to track the movement of the surface oil slick, establish a baseline measurement of coastal ecosystem conditions for a natural resource damage assessment, and assess potential air quality hazards related to the spill and its mitigation. To help address these needs and assist the Federal response to the disaster, NASA deployed several of its airborne and satellite research sensors to collect an unprecedented amount of remotely sensed data over the Gulf of Mexico region. While some of these data were shared with the public via the media, much of the NASA data on the disaster is not well known to the nation's citizens. A need existed to inform the general public about these datasets and to make the data products more understandable to the public. In response, a project was begun by the NASA DEVELOP program to provide outreach to the public on NASA science data collected in response to the spill. The project provides an overview of how these remotely-sensed datasets are being used in oil spill response / recovery research activities. The project also discusses one facet of the DEVELOP project in which we developed and outreached value-added daily MODIS Aqua and Terra products to visualize the movement of the Gulf of Mexico oil slick in a form suitable for public consumption.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
86.	Dr. Damien B Josset *NASA LaRC/SSAI*	Advances in Research Products from combined CALIPSO/CloudSat/radiometric Observations within the A-Train : Aerosol and elevated cloud Optical Depth direct Retrieval over Ocean, Water clouds and Land and first seasonal analyses	Talk	The aerosol radiative forcing is still one of the main uncertainty in climate change. The aerosol optical thickness and aerosol type identification are key properties we need to retrieve accurately to increase our scientific understanding of this forcing. So far, despite the increased sophistication and realism of the aerosol retrieval algorithms, discrepancies still exist between retrievals of aerosol optical depth even over ocean regions. These discrepancies are due to different assumptions in the cloud clearing algorithms, the aerosol models used and different parameterizations of ocean surface reflectance. We will show how we did overcome such issues using a fusion of different A-Train observations (CALIPSO/CLOUDSAT/AMSR-E/MODIS) over dense targets (liquid water clouds, ocean and land surface). This is made possible over the ocean through the use of combined high resolution lidar/radar measurements (both vertical and horizontal), and over land from cloud and land reflectance deduced from CLOUDSAT signal, MODIS radiance and lidar multiwavelength/polarized channels. An analysis of aerosol type can be provided over the ocean. We will present a general overview of the recent advancement we made on those direct optical thickness retrieval of optically thin atmospheric features (aerosol, cirrus clouds), and show first results on the seasonal variability observed over the globe, as compared to well established climatologies from MODIS and PARASOL. One direct consequence of this work is a better understanding of the impact of microphysical properties assumptions in radiometric retrievals and will lead to a better estimation of aerosol and cloud radiative forcing trends due to anthropogenic activities. Data fusion between this direct optical thickness retrieval and collocated passive remote sensing measurements (e.g., PARASOL, MODIS, OMI and GLORY) could enable in the future an AERONET-like of retrieval concept from A-train measurements.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
87.	Dr. Damien B Josset *NASA LaRC/SSAI*	A new approach for checking and complementing Calipso lidar calibration	Poster	Accurate calibration of remote sensing measurements is required to assure the scientific community of the reliability of the data and their suitability for any particular use. More specifically, for geophysical applications, calibrated measurements of two identical scenes should yield identical results, and should not depend on data acquisition time, geographic area, detector history, or the details of a given data product retrieval algorithm. While the degree of accuracy required depends on the individual application, all applications will presumably benefit from calibration improvements. For space-based climate research, the primary calibration issues are achieving consistency over the lifetime an individual detector used in a single mission, and realizing the same degree of consistency for multiple detectors used in two or more similar, yet different missions. In both cases, highly accurate and uniform performance is required in order to decouple calibration drift from actual climate trends. At visible wavelengths, space-based lidars such as CALIPSO can be routinely calibrated using the backscattered signal from very high altitudes. Effective use of this procedure requires accurate knowledge of the local atmospheric density profile, ozone burden, and concentration of stratospheric aerosols. It is also critically important to have sufficient signal to noise ratio from Rayleigh backscatter alone. The consequence of this second condition is that ultraviolet and visible wavelengths are easier to calibrate than infrared, and also that nighttime data is better suited for molecular calibration than daytime data, due to the higher background noise induced by daytime sunlight. We will present here different methodologies which should overcome some of the infrared calibration difficulties for the CALIPSO mission flying in formation within the A-Train. In a first part, we will show how to use the 532 nm CALIPSO channel as a reference for the 1064 nm channel calibration. The ratio of 532 nm to 1064 nm signals will be shown for three calibration targets – ocean surface, liquid water clouds and cirrus clouds. All three targets are expected to offer a stable 532/1064 ratio, but each possess some limitations which will be discussed. In a second part, we will discuss the calibration of the 532 nm and 1064 nm channel separately. We will present comparisons of the 532 nm calibration coefficients derived using Rayleigh scattering as a reference for CALIPSO high altitude return; using the ocean surface return measured by CloudSat as a reference for the collocated CALIPSO ocean return; and using the scattering characteristics of spherical droplets present in liquid water clouds as a reference for the lidar return. The last two methods are expected to show little, if any, wavelength dependence, and thus will also be compared at 1064 nm. When CloudSat is used as a reference, water vapor corrections must be taken into account, and different correction strategies will be presented.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
88.	Dr. Meloe s Kacenelenbogen *ORAU/ NPP AMES Research center*	CALIOP/CALIPSO: Improvement in the retrieval algorithm and a few applications	Poster	The Cloud Aerosol LIdar with Orthogonal Polarization (CALIOP), on board the CALIPSO platform, has measured profiles of total attenuated backscatter coefficient (level 1 products) since June 2006. CALIOP's level 2 products, such as the aerosol backscatter and extinction coefficient profiles, are retrieved using a complex succession of automated algorithms. One of our goals was to help identify potential shortcomings in the CALIOP version 2 level 2 aerosol extinction product and to illustrate some of the motivation for the changes that were introduced in the next version of CALIOP data (version 3, currently being processed). As a first step, we compared CALIOP version 2-derived AOD with collocated MODerate-resolution Imaging Spectroradiometer (MODIS) AOD retrievals over the Continental United States. The best statistical agreement between those two quantities was found over the Eastern part of the United States with, nonetheless, a weak correlation (R~0.4) and an apparent CALIOP version 2 underestimation (by ~66 %) of MODIS AOD. To help quantify the potential factors contributing to the uncertainty of the CALIOP aerosol extinction retrieval, we then focused on a one-day, multi-instrument, multiplatform comparison study during the CALIPSO and Twilight Zone (CATZ) validation campaign on August 04, 2007. This case study illustrates the following potential reasons for a bias in the version 2 CALIOP AOD: (i) CALIOP's low signal-to-noise ratio (SNR) leading to the misclassification and/or lack of aerosol layer identification, especially close to the Earth's surface; (ii) the cloud contamination of CALIOP version 2 aerosol backscatter and extinction profiles; (iii) potentially erroneous assumptions of the backscatter-to-extinction ratio (Sa) used in CALIOP's extinction retrievals; and (iv) calibration coefficient biases in the CALIOP daytime attenuated backscatter coefficient profiles. We then show the use of the CALIPSO aerosol vertical distribution information in two different studies. The first one is aimed at inferring aerosol Particulate Matter (PM) at the ground level for a few case studies over Europe using a combination of CALIPSO and POLDER (POLarization and Directionality of Earth's Reflectances) satellite observations. The second one consists of assessing the frequency of occurrence of significant aerosol loading above clouds. We will attempt to describe the most probable geographical region, magnitude and time of year of those Aerosol Over Cloud (AOC) situations with the use of the CALIPSO vertical feature mask product.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
89.	Brian H Kahn *Jet Propulsion Laboratory*	Probability distributions of cloud and thermodynamic variables from CloudSat/AIRS	Poster	Cloud-climate feedbacks are recognized as the largest source of uncertainty in future climate projections and A-train satellite sensors are providing new information on small-scale cloud properties, temperature and water vapor. First, we observe and quantify small-scale distributions of the atmospheric thermodynamic state including cloud condensate, temperature, and water vapor using the 94 GHz CloudSat radar and the Atmospheric Infrared Sounder (AIRS). Second, we calculate moist conserved variables such as total water content, equivalent potential temperature, and liquid water potential temperature that are not directly observable from the individual CloudSat and AIRS instruments. We expect that significant advances in subgrid-scale cloud parameterizations can be obtained with information on the small-scale distributions of the atmospheric thermodynamic state which including their statistical properties, co-variances, and scale-dependent spectra.
90.	Dr. Ralph Kahn *NASA Goddard Space Flight Center*	MISR's 10-year Record of Aerosol Amount and Type	Poster	Since late February 2000, the Multi-angle Imaging SpectroRadiometer (MISR) instrument aboard the NASA Earth Observing System's Terra satellite has been collecting global observations about once per week. Retrieving aerosol optical depth (AOD) and aerosol type from the 36 channels of data has been a major focus of the MISR Team. Aerosol type is a categorical quantity reflecting available constraints on column-effective particle size, shape, and single-scattering albedo (SSA). MISR data has also been used to map aerosol plume height near wildfire, volcano and dust storm source regions. The aerosol product validation program has produced detailed assessments of uncertainties, strengths, and limitation, based on the combination of theoretical sensitivity studies, statistical comparisons with AERONET surface sun-photometer data, and case studies where coincident, multi-platform field campaign data were acquired. Building on the strengths, and taking the caveats into account, the MISR aerosol products have been used to study regional-scale, short- and long-wave aerosol radiative forcing, monitor dust plume evolution, and air quality, map aerosol air mass type evolution, and validate aerosol transport model simulations. Many of these applications have taken advantage of complementary EOS-instrument measurements, such as spatially extensive AOD observations from MODIS, and downwind aerosol height profiles from CALIPSO. This talk will briefly review current MISR aerosol product strengths and limitations, highlight some of the most recent applications, and summarize planned algorithm upgrades and product extensions.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
91.	Dr. Olga V Kalashnikova *Jet Propulsion Laboratory*	East Asian dust climatology as seen by MISR, MODIS, and OMI: semilarities, differencies, and implications to climate models.	Poster	Satellites, in addition to ground-based observation, provide important observational constraints for modeling dust production and improving the understanding of the effects of regional-scale atmospheric processes on dust emission and transport. Satellite retrieval of aerosol optical depth (AOD) over bright desert surfaces is particularly challenging, as signal from aerosol scattering is typically small compared to surface reflection at visible wavelengths. Although instrument characteristics and retrieval algorithms are different they should ideally produce consistent climatology of the aerosol properties for a given desert region. We analyzed aerosol data from the current generation of EOS and A-train satellite instruments including 10-year record from the Multi-angle Imaging SpectroRadiometer (MISR) aboard Terra, 7-year Deep Blue record from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard Aqua, and 5-year record from Ozone Monitoring Instrument (OMI) aboard Aura to determine similarities and differences in Asian dust climatology provided by these sensors. Multi-year mean spatial patterns, seasonal cycle, and inter-annual springtime variability/anomalies of AOD and aerosol index (AI) were examined over two largest active dust sources in East Asia: the Taklimakan and the Central Gobi, that differ in topography, surface geomorphology, wind/precipitation patterns, and dust emission strength. The dust activity in these regions is not expected to vary significantly between 10:30am and 1:30pm local times, which facilitates inter-comparative studies of Terra and the A-train sensor observations. To further assess satellite product information content, we perform an extensive comparison of satellite aerosol climatology with AERONET/other surface measurements. We show that MISR, MODIS Deep Blue and OMI climatology agree in terms of monthly multi-year mean spatial AOT patterns (except Aprils), show similar seasonal behavior in the Central Gobi region, and all have strong springtime anomalies (especially in Aprils). Even though April seems to be a challenging month for satellite AOT spatial distribution observations, identified similarities in multi-year mean spatial patterns provide important observational constraints on the dust source locations for global climate and regional transport modes. The similarities in satellite-identified source-specific inter-annual variability and anomalies reveal the role of region-specific meteorological regimes associated with dust events, and provide valuable information for Asian dust climate studies.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
92.	Jayanta Kar *Science Systems and Applications Inc.*	Summertime aerosols over the South Eastern United States from CALIPSO and other A-Train measurements	Poster	A strong summertime aerosol plume is observed over the South Eastern states of US in the satellite measurements of the column integrated aerosol optical depth. It has been hypothesized that the aerosol content is not dominated by the sulfates at the surface level but by secondary organic aerosols formed by oxidation of the biogenic precursors above the surface level. We use the recently released version 3 CALIPSO aerosol data along with data from MODIS and OMI to characterize these summertime aerosols. This version of CALIPSO data has significant improvements resulting from the improved cloud-aerosol discrimination algorithm and extension of aerosol profiles below layers with strong attenuation. The total aerosol optical depths from version 3 data confirm the summertime plume over the South Eastern states. The seasonal development and inter annual variation of the plume will be studied. These results will be compared with aerosol measurements from other instruments on the A-train, i.e. MODIS and OMI. Further, the height resolved CALIPSO aerosol data for the first time provides information on the altitude dependence of the aerosol layers above this area. The results suggest strong contribution to the optical depth in summer from elevated layers a few kilometers above the surface. This would be consistent with the suggested mechanism wherein secondary organic aerosols contribute significantly to the total aerosol loading. The optical properties and inter annual variations of the aerosols in these layers will be presented.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
93.	Dr. Seiji Kato *NASA Langley Research Center*	Computation of surface irradiances using CALIPSO, CloudSat and MODIS derived cloud and aerosol properties	Poster	Cloud vertical profiles retrieved from CALIPSO and CloudSat data provide additional information that greatly improves the estimate of atmospheric radiative heating rates and potentially improves the estimate of the global surface radiation budget. To utilize CALIPSO and CloudSat cloud vertical profiles, we combined their profiles and generated merged profiles. We used the merged cloud profiles and MODIS derived cloud profiles by the CERES cloud algorithm in irradiance computations. In this study, the improvement of the irradiance by CALIPSO and CloudSat derived merged cloud vertical profiles is evaluated by comparing modeled irradiances with and without merged cloud profiles. Because of lower cloud base heights provided by the merged profiles compared with cloud base heights derived from an empirical formula using the MODIS derived cloud top height and optical thickness, the global annual mean surface longwave downward irradiance increases approximately by 7 Wm-2. While CALIPSO version 3 data have not been incorporated in the irradiance computation and the effect of the new CALIPSO data needs to be assessed, a comparison with surface observations suggests an improvement of surface downward longwave irradiance computations. The surface downward longwave irradiance computed with CALIPSO and CloudSat merged clouds agrees better with surface observations than the irradiance computed with MODIS only does. The bias difference over ARM SGP sites with 2 years of data decreases from -5 W m-2 to -2 Wm-2, and it decreases from -9 Wm-2 to no bias over polar validation sites. The result suggests that CALIPSO CloudSat derived merged clouds significantly improve surface longwave irradiance estimates once they are combined with MODIS derived cloud properties and with temperature and humidity profiles from reanalysis.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
94.	Dr. Kazu Kawamoto *Nagasaki University*	Vertical characteristics of liquid hydrometers in view of column cloud droplet number	Poster	This study analyzed vertical characteristics of liquid hydrometers (cloud droplets, drizzle and rain drops) in terms of column cloud droplet number (Nc) using mainly CloudSat products to get better understanding of cloud to rain conversion processes. Recently, Suzuki et al. (2010) et al. developed CFODD (Contoured Frequency by Optical Depth Diagram) from CloudSat and MODIS datasets. This diagram illustrated normalized frequencies of radar reflectivity (Ze) as a function of the layered optical depth (tauc) that was determined by an adiabatic-condensation growth model. Motivated by the finding of Kawamoto (2008) that water cloud properties such as Nc and effective particle radius (re) could be controlled by the precipitation amount, we drew CFODDs according to Nc to investigate the dependency of hydrometers behaviors on Nc. Preliminary analysis of the Amazon region (1500km circle centered on ≅7S and ≅60W) revealed following features. Smaller Nc case had two modes; (1) small values of both tauc and Ze (initial mode) and (2) large values of both tauc and Zc (precipitation mode). And this case covered until large Ze (~20dBZ) which indicated precipitation. On the other hand, larger Nc case lacked of large Ze and had frequent bins in small Ze (~-20dBZ) which suggested no rain. Although comparison between DJF and JJA showed generally similar tendencies for both less and more Nc cases, there appeared some differences in frequency values which might be caused by difference in precipitation amount.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
95.	Prof. Adil. H Khan Sr. *Jiwagi University India Govt.Kasturba Girls College Guna M.P.India*	ATMOSPHERE: Origin Of Atmospheric Pollution (Aerosols, Clouds , Water Cycle) and study of key sources of satellites , Space Shuttle & Rockets "	Poster	Aerosols is the smallest part of the atmosphere it's activity creating unbalanced the atmospheric composition . The composition of the clouds Aerosols and hydrological cycle are connected with radiation In single word we can say that it's a reaction of various exited and non exited Chemical in the atmosphere . Aerosols origin based on soil erosion , dust particles , Val cones ,forest and the activity of the wild life animals , human activities(Industry , Vehicle Pollution, & etc.) , such as the burning of fossil fuel , dust storms ,Sea spray etc. In similarly the origin of aerosols is effecting to all the part of pollution in other word we can say that aerosols is the smallest unit of the pollution .In the origin of aerosols is the starting process of pollution . The tiny particles (aerosols) origin depend in to the human activity in the atmospheric planet . These aerosols start the absorption of radiation or in other word we can say that start the reaction between the aerosols and radiation because both origin are chemically and the similarity is that both are the exited state of the chemical's in the atmosphere . They also produce brighter clouds that are less efficient at releasing precipitation. These in turn lead to large reductions in the parts of the radiation reaching Earth's surface, these radiation's heating of the atmosphere, changes the composition of the atmospheric temperature, unbalanced rainfall, and small amount removal of pollutants. These aerosol are creating the weaker hydrological cycle in day by day , which is connecting directly to availability and quality of water in the river and other sources of water , a major environmental problem of the today scenario.
96.	Dr. Michael D King *University of Colorado*	Spatial and Temporal Distribution of Clouds as Observed by MODIS Onboard the Terra and Aqua Satellites	Poster	The Moderate Resolution Imaging Spectroradiometer (MODIS) was developed by NASA and launched onboard the Terra spacecraft on December 18, 1999 and Aqua spacecraft on May 4, 2002. A comprehensive set of operational algorithms for the retrieval of cloud physical and optical properties (optical thickness, effective particle radius, water path, thermodynamic phase) have enabled over ten years of continuous observations of cloud properties from Terra and over eight years from Aqua. The archived products from these algorithms include 1 km pixel-level (Level-2) and global gridded Level-3 products. The cloud products have applications in climate change studies, climate modeling, numerical weather prediction, as well as fundamental atmospheric research. Results include the latitudinal distribution of cloud optical and radiative properties for both liquid water and ice clouds, as well as latitudinal distributions of cloud top pressure and cloud top temperature. In addition to time series of cloud fraction, cloud optical properties, and cloud top properties, we will also present marginal probability density functions as well as joint probability density functions of cloud optical thickness, effective radius, and cloud top pressure for selected geographical locations around the world.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
97.	Richard Kleidman *SSAI / NASA*	Evaluation and windspeed dependence of MODIS aerosol retrievals over open ocean	Poster	We use the MAN (Maritime Aerosol Network) data as a basis to evaluate the MODerate resolution Imaging Spectroradiometer (MODIS) over-ocean aerosol products of spectral AOD and Angstrom Exponent. This is the first comprehensive evaluation of the MODIS aerosol product over the open ocean, and allows for the quantification of retrieval biases with wind speed.
98.	brigitte koffi *LSCE, Gif sur Yvette, France*	Global evaluation of aerosol vertical distribution simulated by AeroCom global climate models using CALIOP observations.	Poster	The vertical distribution of tropospheric aerosol is of crucial importance in radiative-transfer calculations and for the study of aerosol-cloud interaction. The high variability of aerosol load, both in space and time, makes it difficult to quantify their current impact on the Earth radiative forcing and to assess their contribution to future climate change. Passive space-borne observations have been used to evaluate the 2D distribution of aerosol load simulated by the models, but the vertical distribution could not be evaluated as well, until the launch of active sensors. The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) are used here to evaluate the aerosol Extinction Coefficient (EC) profiles simulated in the framework of the AeroCom I and II modelling experiments. First, we describe the calculation of the EC profiles in all and in clear sky conditions from the CALIOP (Cloud-Aerosol Lidar with Orthogonal Polarization) Level 2 Layer 5 km resolution product. Improvements obtained from the CALIOP version 3 compared to the version 2 data are illustrated, as well as the inter-annual variability. Geographical patterns and seasonal variations are then compared with those obtained from numerical experiments by 7 GCMs. Results generally show a good agreement in both magnitude and vertical distribution between the observations and the simulations in most of the northern hemisphere industrial regions (U.S., Europe and to a less extent East China), except India. In these regions, the typical height of aerosol load and its seasonal variations are well reproduced by several models. Most of the models are also shown to well reproduce the averaged aerosol profile over the Saharan region, and some of them, the subsequent transport of the Saharan dust over the Atlantic Ocean, in summer. In biomass burning regions (South Africa, South America, South East Asia), and in western China, the simulated EC are lower than the ones calculated from CALIOP observations. Possible factors contributing to the models biases and discrepancies are currently being investigated on the basis of additional observation data and analyses.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
99.	Dr. Terry L Kubar *Jet Propulsion Laboratory/Caltech*	Controls on Tropical Low Cloud Cover and Cloud Heterogeneity Using A-Train Satellite Data and ECMWF Analyses	Talk	Calipso lidar, CloudSat radar, and MODIS cloud data on the A-train constellation complemented with European Center for Medium Range Forecasts (ECMWF) analyses are used to investigate the cloud and boundary layer structure across a 10° wide cross section starting at 5°S near the International Dateline and extending to 35°N near the California Coast from March 2008-February 2009. The mean large-scale inversion height and low-level cloud tops, which correspond very closely to each other, are very shallow (~500 m) over cold SSTs and high static stability near California, and deepen southwestward (to a maximum of ~1.5-2.0 km) along the cross section as SSTs rise, until buoyancy maximizes and deep convection occurs near the ITCZ, corresponding to surface temperatures of ~298K. While the boundary layer relative humidity (RH) is nearly constant where a boundary layer is well defined, it drops sharply near cloud top in stratocumulus regions, corresponding with strong thermal inversions and water vapor decrease, such that maximum ($-\partial RH/\partial z$) marks the boundary layer cloud top very well, and the magnitude correlates well with low cloud frequency during March-April-May (MAM), June-July-August (JJA), and September-October-November (SON) (r2=0.85, 0.88, 0.86, respectively). Dynamical mean tropospheric ω between 300 hPa and 700 hPa is examined from the ECMWF Year of Tropical Convection (YOTC) analysis dataset, and at least during JJA and SON, strong rising motion in the middle troposphere is confined to a range of 2-m surface temperatures between 297 K and 300 K. During December-January-February (DJF), large-scale ascending motion extends to colder SSTs and high boundary layer stability. A boundary layer stability metric is derived, the difference of moist static energy (MSE) at the middle point of the inversion (or at 700 hPa if no inversion exists) and the surface, referred to as ΔMSE. The utility of ΔMSE is its prediction of uniform low cloud frequency unobstructed by clouds with middle or high tops, with very high r2 values of 0.93 and 0.88, respectively, for MODIS and Joint lidar+radar product during JJA, but significantly lower values during DJF (0.46, 0.40), with much scatter. To quantify the importance of free tropospheric dynamics in modulating the ΔMSE-low cloud relationships, the frequency as a function of ΔMSE of rising motion profiles (ω<-0.05 Pa s-1) is added to the observed low cloud frequency for a maximum potential low cloud frequency. Doing this greatly reduces the interseasonal differences, and holds promise of using ΔMSE for parameterization schemes and examining low cloud feedbacks. Some preliminary results of low cloud heterogeneity and identification of global stratocumulus and trade cumulus regimes from the MODIS level-3 dataset are also shown.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
100.	Dr. Mark S Kulie *University of Wisconsin-Madison*	Snowfall From Space: Using A-Train Observations to Constrain Ice Microphysical Assumptions	Poster	Observations from A-Train member instruments are used to investigate precipitation at higher latitudes through an integrated observational and modeling approach. This observational/modeling system is primarily used to assess certain microphysical assumptions about frozen hydrometeors in a radiative closure experiment using coincident A-Train active (CloudSat) and passive (AMSR-E) microwave sensors. First, a snowfall dataset is derived using CloudSat observations. This dataset provides a unique opportunity to compile and investigate previously rare combined active and passive observations of snowfall on a global basis. An ice particle model database containing microwave properties of over twenty ice habits is also compiled and serves as the centerpiece of both a radar-based snowfall retrieval scheme and the combined active/passive modeling system. Equivalent radar reflectivity factor (Ze) – snowfall rate (S) and ice water content (IWC) relationships are first derived, and their sensitivity to ice model, size distribution, and temperature are demonstrated. Next, a combined active/passive modeling system that converts CloudSat Cloud Profiling Radar (CPR) observations to simulated passive microwave brightness temperatures (TB) is utilized to physically assess the ice particle models under precipitating conditions. Simulation results indicate certain ice models (e.g., low-density spheres) produce implausibly low simulated TB's for stratiform snow and low-freezing level rain events and indicate the inability for such models to possess physically realistic scattering and extinction properties for higher microwave frequencies. An ensemble of non-spherical ice particle models, however, consistently produces more physically realistic results and adequately captures the microwave radiative properties of frozen hydrometeors associated with precipitation – with the possible exception of very high IWP events. Large derived IWP uncertainties are also noted and may indicate IWP retrieval accuracy limitations using passive microwave observations. Simulated brightness temperature uncertainties due to the ice particle model can approach 9 (5) K at 89 (157) GHz for high IWP conditions associated with mid-latitude synoptic snowfall cases and ~2-3 (~1-2) K under typical mid-latitude stratiform rain conditions. These uncertainties – and sample error correlations and covariances for select microwave frequencies - display distinct variability due to IWP, precipitation type, satellite zenith angle, and frequency.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
101.	Tristan S L'Ecuyer *Colorado State University*	Probing Radiative Heating Within the Atmosphere with Multi-sensor A-Train Observations	Talk	Given the urgent need to evaluate and improve climate prediction tools, there is growing demand for accurate observationally-based estimates of fluxes of radiative energy not only at the top of the atmosphere but also within it. Aside from being central players in global energy balance, the structure of radiative heating in the atmosphere and at the surface heating plays an important role in defining atmospheric circulations and regional and global water cycles. With its unique combination of active and passive sensors, the A-Train provides an unprecedented tool for examining the distribution of radiative heating within the atmosphere. This presentation will describe an algorithm for profiling radiation within the atmosphere at high vertical and spatial resolution using observations from CloudSat, CALIPSO, MODIS, and AMSR-E aboard the A-Train. The resulting dataset will be used to characterize regional energy budgets at the continental/basin scale and to contrast the impacts of clouds with different morphologies on regional radiation budgets. Particular emphasis will be given to the vertical structure of radiative heating within the atmosphere.
102.	Dr. Alyn Lambert *Jet Propulsion Laboratory*	Colocated A-Train Observations of Upper Tropospheric Clouds, Atmospheric Composition and Polar Stratospheric Clouds	Poster	Synergistic measurements from A-Train instruments using active lidar/radar, visible, infrared and microwave techniques are allowing the structure of clouds to be probed in unprecedented detail. Following a re-configuration of the Aura Satellite within the A-Train after April 2008, the Aura MLS limb tangent points are collocated across-track to within ten kilometers of the CALIPSO/CloudSat nadir field of view and the temporal sampling differences are less than 30 seconds. We demonstrate the utility of the precise colocated measurements by presenting observations of (a) upper tropospheric clouds using the MLS 240 and 640 GHz limb radiances and CALIPSO/CloudSat and (b) development of polar stratospheric clouds by CALIPSO and gas-phase nitric acid by Aura MLS in the early 2008 Antarctic winter.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
103.	Mr. Timothy A Lawson *Naval Research Laboratory*	Comparison of Long Island Sound and Martha's Vineyard Waters: Satellite and in situ sensors	Poster	As a part of an automated system to facilitate calibration and validation of satellite products, we compare satellite-derived bio-optical properties to in situ measurements, at two geographically close but optically distinct areas. These comparisons enable us to assess the accuracies of the satellite retrievals, and factors that impact those accuracies (natural variability, atmospheric correction errors, sensor resolution). Both high (250m) and low (1km) resolution MODIS Aqua products are compared against ocean color data collected by Seaprism sensors (part of NASA's AErosol RObotic NETwork, AERONET), providing both spatial and temporal comparisons against the in situ data at two geographical areas with different water types. The products examined are normalized water leaving radiance and aerosol optical depth. Matchups from January 2010 to June 2010, showing seasonal trends as the temperature and weather shift in the first half of the calendar year, are presented. The two sites chosen are the Coastal Observatory in Long Island Sound(LISCO), where the Seaprism is located near river outflow, and Martha's Vineyard Coastal Observatory(MVCO), which is located in comparatively clear, open water. Time series analyses enable assessments of trends in the data sets. We examine differences between the LISCO and MVCO sites, as well as within-area differences through comparisons of the 250 meter and 1000 meter resolution MODIS products. These graphical and statistical analyses help detect deviations between the satellite and in situ values, and highlight the impact of higher resolution satellite data for coastal areas.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
104.	Louise Leahy *University of Washington*	Marine boundary layer albedo continuum investigations utilizing A-Train active and passive remote sensing instruments, and air-borne lidar data.	Poster	Planetary albedo is a key parameter in determining the Earth's radiation balance. Top-of-atmosphere (TOA) albedo calculations are based upon reflectivity contributions from clear and cloudy atmospheric states. However, a recent study presented regional distributions of a TOA reflectivity metric, which revealed a non-zero minimum between the clear and cloudy modes of the distribution. The study also found this minimum, or continuum region, comprised mainly optically thin clouds. Results from space-borne passive remote sensing data suggest that approximately one-third of marine low-clouds between ±45° have optical depths less than 3, and contribute approximately 10% to cloud albedo. Modeling studies show that the albedo of these thin clouds is more susceptible to microphysical and macrophysical changes in their environment, than the albedo of optically thicker clouds. Although some space-borne passive remote sensors (e.g. the Moderate Resolution Imaging Spectroradiometer (MODIS)) have the sensitivity to detect optically thin clouds, very little is currently known about the spatiotemporal distribution of the continuum region features. The Cloud-Aerosol Lidar with Infrared Satellite Observation (CALIPSO) satellite was launched in June 2006, carrying the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instrument. CALIOP non-polar ocean data will be used for this work, providing high vertical and horizontal resolution TOA 180° backscatter data, with no contamination from surface return. Vertically resolved information is key to understanding not only the vertical extent of these continuum region features, but also their vertical location relative to adjacent aerosol layers. These aerosols are potential sources of cloud condensation nuclei. Air-borne High Spectral Resolution Lidar data will also be utilized to investigate continuum region features at the higher horizontal resolution of, approximately, 60 m compared to 330 m for CALIOP. The CALIOP laser footprint is 70 m in diameter, therefore, MODIS data will be used to provide a broader geographical context for the analysis, e.g., to establish whether continuum region features are typically associated with shallow cumulus clouds or expansive stratus decks. The primary tool for the analysis is the vertically integrated attenuated backscatter (IABS) signal. Initial results indicate a continuum region is clearly evident in CALIOP IABS distributions, on both global, and regional scales.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
105.	Dr. Matthew D Lebsock *Colorado State University*	A-Train sensor synergy for the remote sensing of marine boundary layer clouds.	Poster	Marine boundary layer clouds demonstrate a particular fragility with respect to perturbations in both their thermodynamic and microphysical environments. This fragility leads to large uncertainties in quantifying the forcing exerted on the climate system through aerosol indirect effects and the radiative cloud feedbacks associated with changes in cloud morphology in a perturbed climate. Single-sensor remote sensing methodologies offer a valuable but limited view of marine boundary layer clouds. The unique combination of instruments flying in the A-train constellation offer the potential for sensor synergies that will enhance our view of these climatically critical cloud regimes. In particular, we examine the possibility of simultaneously retrieving the cloud and precipitation water path using physically based combinations of MODIS, AMSR-E and CloudSat data. The separation of the cloud and precipitation signals relies heavily on the relative insensitivity of the optical observations to the presence of precipitation in conjunction with the strong sensitivity of the microwave observations to precipitation. The retrieval methodologies presented have clear advantages over retrievals that rely on any of the three instruments alone. Initial results highlight both microphysical and macrophysical controls on the production of precipitation, which suggests potential implications for quantifying aerosol indirect effects and cloud radiative feedbacks.
106.	Dr. Seungwon Lee *Jet Propulsion Laboratory*	Co-locating A-train observations and ECMWF analysis outputs for comprehensive understanding of the Earth's weather and climate	Poster	The A-Train satellite constellation provides global, near-simultaneous, multi-sensor observations of the Earth's atmosphere, ocean and land systems. While the coordinated measurements from the A-Train's five different satellites provide comprehensive information about the Earth's weather and climate processes, the synergistic use of the multi-sensor measurements are not widely utilized because data from different instruments are heterogeneous due to the different spatial sampling characteristics and the different formats and structures of the retrieval products, as well as the data sets being in different data archives. We have developed a scientific software tool to temporally and spatially co-locate A-train constellation multi-sensor observations to facilitate their synergistic use. In addition, the tool can also co-locate ECMWF (European Center for Medium-Range Weather Forecasts) atmospheric analysis outputs so that direct comparisons can be made between the analysis and observations for validation purposes, and additional dynamical context information can be provided by the ECMWF values for more comprehensive analysis of the satellite observations. This paper presents information technologies and algorithms developed for the co-location tool, validation work, and results of applying the tool to co-locate data from instruments MLS, MODIS, CERES, AIRS, AMSR-E, CALIPSO and analysis outputs from ECMWF with CloudSat footprint locations. This paper also presents scientific applications of the co-located data set.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
107.	Dr. Seungwon Lee *Jet Propulsion Laboratory*	Systematic and characteristic differences between NASA observational data and CMIP5 outputs for model evaluations	Poster	A new set of coordinated climate model experiments, known as CMIP5, have been designed and are being undertaken by the participating modeling groups in order to address outstanding scientific questions that arose as part of the IPCC AR4 assessment process, improve understanding of climate, and to provide estimates of future climate change. In parallel, several NASA instrument teams are generating observational data sets that are analogous to the outputs of several retrospective CMIP5 simulations (e.g. 20th century coupled simulations) in order to facilitate model-to-observation comparisons for model diagnostics and evaluations. Along with the data sets, technical notes are being written to enable the proper use of the data sets in the context of model-observation comparisons and CMIP5 evaluations. The technical note is aimed at a general scientist who is not necessarily a remote-sensing expert nor a climate model expert. The technical note covers data field description, data processing history, data validation work, and instrument overview. In addition, the note describes systematic and characteristic differences between the observational data sets and the model outputs. Although the data sets are similar to the model outputs in terms of file format, data structure, and spatial and temporal resolution (e.g. 1x1 degree gridded, monthly averaged data), several key factors distinguish the observational data from the model outputs. Some differences are evident such as time sampling and space sampling schemes, but other differences are rather subtle such as instrument sensitivity effects, model assumptions, and retrieval limitations. It is important to take into account the differences in the model-to-observation comparison. We have studied and documented the systematic and characteristic differences for several observational data sets including MLS ozone and temperature, AIRS temperature and water vapor, and TES ozone. In this presentation, we will report on the progress and plans of defining the target readers, breath, and depth of the technical notes and producing the notes.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
108.	Mrs. Cyndie Lemaître *LATMOS/IPSL/CNRS*	Radiative impact of a major springtime dust event on the West African Monsoon system dynamics .	Poster	Three-dimensional mesoscale numerical simulations were performed over West Africa in order to investigate the radiative impact of mineral dust on the West African Monsoon (WAM) system dynamics. The study focus on an intense and long-lasting episode of dust being lifted in remote sources in Chad and Sudan and transported across West Africa in the African easterly jet (AEJ) region (9-15 June 2006). Ground-based data, space-borne and airborne observations acquired during the AMMA (African Monsoon Multidisciplinary Analysis) Special Observation period are used to determine the relevance of the model. The comparison with observations from the A-Train (CALIOP, IIR, MODIS & OMI), data from SYNOP stations as well as from instrumented aircraft suggests that the model can be used reliably to analyze and quantify the dynamical impact of dust in this region. This study suggests that dust significantly impacts the atmospheric dynamics of the WAM by modifying the temperature in the region of the AEJ. The dust-induced heating contributes to enhance static stability in the AEJ region as well as modifies the thermal equilibrium at the regional scale, thereby impacting the strength of the AEJ and that of the monsoon flow underneath.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
109.	Mrs. Cyndie Lemaître *LATMOS/IPSL/CNRS*	Radiative heating rate profiles associated with a springtime case of Bodélé and Sudan dust transport over West Africa	Poster	Aerosols affect the Earth energy budget directly by scattering and absorbing radiation and indirectly by acting as cloud condensation nuclei. However, large uncertainties exist in current estimates of aerosol forcing. In this presentation, the impact of aerosol on solar and Infra-Red fluxes and the heating rate due to dust over West Africa are investigated using the radiative code STREAMER, as well as satellite observations, space-borne and dropsondes observations gathered during the African Monsoon Multidisciplinary Analysis Special Observing Period. Aircraft operations were conducted on 13 and 14 June 2006, over Benin and Niger, before and after the passage of a mesoscale convective system (MCS). On these days the dust observed over Benin and Niger originated from the Bodélé depression and from West Sudan. In this study, are used aerosol extinction coefficient derived from lidar observations, temperature, pressure, water vapour profiles derived from dropsondes and clouds properties. The surface albedo is diagnosed from MODIS observations. A serie of retrieval is carried out on between 9 and 15 June 2006 to investigate the dust radiative forcing as a function of latitude, from 6°N to 15°N, i.e. Between the vegetated coast of the Guinea Gulf and the arid Sahel. The retrievals are made both in terrestrial and in solar spectrum and show a maximum heating rate associated with the dust plume on these days was between 1.5 K day-1 and 3 K day -1, depending on the latitude and the concentration of dust. The maximum heating rate is observed to the North, where a deep plume of dust is detected. This maximum is diagnosed around 3 km where the concentration of dust is significant. Sensitivity studies to surface albedo, aerosol backscatter-to-extinction ratio, temperature,water vapor mixing ratio profiles and cloud properties are also conducted.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
110.	Mrs. Julie Letertre *Laboratoire d'Optique Atmosphérique*	Remote Sensing of Tropospheric Aerosols over Ocean using A-Train Measurements.	Poster	Within the A-Train constellation of satellites, POLDER/PARASOL and MODIS/AQUA are the two major sensors for retrieving aerosol properties from space. When MODIS is measuring the solar radiation reflected by the Earth-atmosphere system in up to seven useful channels, from 0.47 to 2.2μm, PARASOL is taking advantage of its capability to view the same pixel with different geometrical conditions and by measuring the polarized radiances in 3 channels, 0.49, 0.67 and 0.86μm. Both radiometers fly over the same area quasi simultaneously and combining all the measurements seems to be particularly attractive. We first invert the PARASOL measurements over ocean and by using the retrieved aerosol properties, we can simulate the MODIS radiances in the channel 2.1μm that is not available on PARASOL. Comparisons between the simulated (noted Lparasol) and the measured radiances (noted LMODIS) are then informative on the additional information that MODIS can provide or not at 2.1μm. The calibration issue and the corrections for gazeous absorption are considered. Results are presented over two regions, the Atlantic and Pacific ocean for the whole common data archieve. The two sensors were observing the same area before March 2005 up to November 2009. We calculate the ratio R2100=(LPARASOL-LMODIS)/(LPARASOL+LMODIS) and we average it over boxes of 1° of longitude and 20° of latitude when we have at least 30 observations within each box. As we expect different spectral behaviors, the aerosol types are classified using values of the Angstrom coefficients α = log (τ865/ τ670)/log (865/670), where the $\tau\lambda$are derived from the PARASOL inversion. Over the Atlantic ocean, we select two cases, below 0.2 for large (dust) particles and between 0.2 and 1.3 for mixed cases (dust and biomass burning). Over the Pacific ocean, we select only small particles (biomass burning or pollution cases) by considering values of α larger than 1.3. We also discriminate by aerosol contents using aerosol optical depth (AOD) at 865nm, large content (AOD > 0.2) and low content (AOD<0.2).

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
111.	Robert C Levy *SSAI*	The AeroCenter perspective on the Iceland Volcano	Poster	AeroCenter is a semi-formal network of aerosol "investigators" based at NASA's Goddard Space Flight Center (GSFC) in Maryland. Originally proposed by Yoram Kaufman more than ten years ago, AeroCenter provides a framework for organizing technology, data, ideas and people involved in aerosol research from GSFC and its neighbors. We have over 210 members on our listserv and a web site (http://aerocenter.gsfc.nasa.gov). There is a bi-weekly seminar series on all things aerosol, an annual aerosol "update", and other events scattered throughout the year. In the last year, AeroCenter has gone "global", providing a WebEx feed on all seminars. On April 14, 2010, Iceland's Eyja Volcano began spewing ash into the atmosphere. Over the next few days, transport and processing of the ash led to a thick cloud that wreaked havoc on Europe's aviation industry. Since the event garnered so much media coverage, the AeroCenter organized a special event to show off some of the spectacular imagery created from the synergy of remote sensed observations, retrievals and modeling. Some of these images are presented here.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
112.	Dr. jiming Li *Department Physics and Engineering Physics, Stevens Institute of Technology*	A new method for retrieval of the extinction coefficient of water clouds by using the tail of the CALIOP signal	Poster	A method is developed based on Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) level 1 attenuated backscatter profile data for deriving the mean extinction coefficient of water droplets close to cloud top. The method is applicable to low level (cloud top < 2 km), opaque water clouds in which the lidar signal is completely attenuated beyond about 100 meters of penetration into the cloud. The photo multiplier tubes (PMTs) of CALIOP's 532 nm has a well-characterized transient response (Hu et al., Optics Express, 2007). Therefore, the effects of any transient responses of CALIOP on the attenuated backscatter profile of the water cloud must first be removed in order to obtain a reliable (validated) attenuated backscatter profile. Then, the slope of the exponential decay of the validated water cloud attenuated backscatter profile, and the multiple scattering factor are used for deriving the mean extinction coefficient of low-level water cloud droplets close to cloud top. This novel method was evaluated and compared with the previous method by combining the cloud effective radius (3.7-μm) reported by MODIS with the lidar depolarization ratios measured by CALIPSO to estimate the mean extinction coefficient. Statistical results show that the extinction coefficients derived by the new method based on CALIOP alone agree reasonably well with those obtained in the previous study using combined CALIOP and MODIS data. Their mean absolute relative difference in extinction coefficient is about 13.4%. An important advantage of the new method is that it can be used to derive the extinction coefficient also during night time, and it is also applicable when multi-layered clouds are present. Overall, the global mean cloud water extinction coefficients during different seasons range from 26.17 to 29.46 /km, and the differences between day and night time all are small (about 1/km.). The global mean layer-integrated depolarization ratios of water cloud during different seasons range from 0.2 to 0.23, and the differences between day and night also are small, about 0.01.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
113.	Dr. JUILIN Li *JPL/NASA/CalTech*	Radiative Impacts of Precipitating Hydrometeors on Atmosphere Circulation Features in Weather and Climate Models	Poster	Climate models such as those used in the Intergovernmental Panel on Climate Change (IPCC) assessments, often ignore the radiative impacts of precipitating hydrometeors (e.g., rain, snow) due in part to the perception that the combination of their limited spatial extent, short life time and large particle radii make them incapable of having a tangible radiative impact on the atmosphere. Moreover, the limited observations of the amount of precipitating hydrometeor mass in the atmosphere makes the validation of radiative impact calculation difficult. Because of these factors, global models ignore the radiative processes associated with falling hydrometeors and only consider the "suspended" water in radiation calculations. As a result, such models are likely achieving top of atmosphere (TOA) agreement with observations through compensating errors which however introduce atmospheric circulation, hydrometeors, precipitation and land/sea surface temperatures biases. By using the ice particle size distribution parameters estimated by the CloudSat retrieval algorithm, CloudSat retrievals of ice water content provide one of the first comprehensive means to estimate the amount of precipitating ice mass in the atmosphere and characterize its vertical structure. We perform a series of sensitivity tests in order to examine the global scale differences arising from exclusion/inclusion of the precipitating hydrometeors for radiation calculations on atmospheric radiative fluxes and heating rates, as well as surface precipitation and dynamics using ECMWF IFS, GSFC/GEOS5, a cloud resolving GCM-fvMMF. We also examine regional impacts using the WRF model. These results will demonstrate the usefulness of considering both suspended and precipitating atmospheric water mass to evaluate and constrain model representations of cloud-radiative processes and feedbacks.
114.	Prof. Zhanqing Li *University of Maryland*	Discernible Effects of Aerosol on Cloud and Precipitation Revealed from the Analyses of A-train Space-borne and ARM Ground-based Measurements	Poster	Aerosol's impact on cloud and precipitation has drawn much attention with ample findings that often differ drastically. To gauge the differences and understanding their causes, a comprehensive investigation is conducted by analyzing both the long-term extensive ground-based data and global A-train multi-sensor products. First, we exploited the 10-year worth of ARM observations of aerosol, cloud, precipitation, radiation and general meteorological variables. Robust relationships were revealed between aerosol, cloud and precipitation under varying atmospheric conditions to reveal unprecedented long-term net impact of aerosols on cloud properties and precipitation frequency. The ground-based findings are complemented by analyses of global satellite data (MODIS, CLOUDSAT, CALIPSO, TRMM, etc) over many regions that were carefully chosen to have similar meteorological conditions but distinct aerosol loadings. The responses of cloud particle size for both shallow and deep convective clouds are investigated. They are contingent upon aerosol type and the dynamic settings.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
115.	Dr. Bing Lin *NASA Langley Research Center*	Variations of physical properties of different type marine clouds observed by CERES and MODIS	Poster	Physical and radiative properties of different types of marine clouds are evaluated using CERES and MODIS measurements from the Aqua satellite. Their variations are statistically analyzed. Generally, same types of clouds from different areas have different radiative fluxes due mainly to the differences in solar insulation and local atmospheric profiles. When the same types of clouds are analyzed in the same boreal seasons, the differences in radiative fluxes are remarkably reduced. The liquid water path (LWP) and ice water path (IWP) values for straticumulus and anvil clouds, respectively, exhibit large variability. However, the inter-annual variations in the LWP and IWP distributions are very small, at least in normal climate conditions. The region-to-region variability for the same type of clouds is as large as seasonal variability. Anvils in North Atlantic storm track regions have the largest seasonal variability, while the clouds off the coast of California show minimal variations.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
116.	Alan E Lipton *AER, Inc.*	Assessment of cloud-induced biases in MODIS LST using AMSR-E and diagnosis of inconsistencies between AIRS water vapor products and the microwave measurements	Poster	Past work has focused on deriving a global atlas of monthly averaged AMSR-E emissivity from AMSR-E measurements combined with V.4 Aqua-MODIS LST estimates in clear-sky conditions, using NCEP analysis to specify the atmospheric conditions. Temporal stability of the surface conditions can be monitored using low-frequency AMSR-E brightness temperatures alone, outside of snow-covered and RFI-contaminated areas. These microwave surface emissivities estimates can in turn be used to provide LSTs under cloudy and clear conditions that are consistent with MODIS. IR LST estimates have better spatial resolution than microwave LSTs. IR emissivities also tend to be more stable temporally and are exempt from sub-surface penetration issues that affect microwave measurements in arid conditions. Infrared measurements are, however, highly affected by clouds with the following consequences: - No IR estimate available in overcast conditions - IR LST estimates for a grid point are only representative of the clear portion of the grid - IR LST estimates may be significantly degraded by undetected clouds/dust Here we use the derived AMSR-E surface emissivity database as a means to quantify the impact of these biases on monthly-average IR LST estimates on a global basis (aside from snow) and the impact of surface penetration in the microwave over deserts. Careful regional analysis is performed in attempt to separate cloud biases from residual cloud/dust contamination in V.4 MODIS LST product. We also found that replacing NCEP water vapor with AIRS in the production of the AMSR-E emissivities reduces the temporal standard deviation the retrieved AMSR-E 24-GHz emissivities, especially in the tropics, indicating a high level of consistency between AIRS and AMSR-E in these regions. However this replacement of NCEP with AIRS data causes degradation in some conditions, mostly over Asia and Australia at night. Preliminary results will be presented.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
117.	Alan E Lipton *AER, Inc.*	Cirrus cloud properties retrieved from Aqua/MODIS with CloudSat and CALIPSO validation	Poster	A one-dimensional variational algorithm has been adapted to retrieval of cloud ice water content, top pressure, and particle effective diameter from MODIS infrared data. The information content of this MODIS spectrum is sufficient to retrieve no more than three independent cloud variables in nighttime conditions. A fourth cloud variable that needs to be controlled in the algorithm, the particle size dispersion, is diagnosed with a parameterization borrowed from the CloudSat algorithms, whereby physical consistency with CloudSat was taken to be the preferred approach to complementing the information from MODIS. The algorithm handles radiative transfer with the Optimum Spectral Sampling (OSS) method for fast and accurate treatment of molecular absorption/emission across each sensor band. OSS uses optimal weighting of monochromatic calculations at optimally selected spectral points. The treatment of multiple scattering is economized by doing scattering calculations at fewer points than are needed for molecular effects, with explicit control over error tolerances. The algorithm has been oriented toward global, real-time production of cloud products and data assimilation. The variational framework ensures radiometric consistency among the retrieved cloud properties, and thus facilitates conversion between retrieved physical/microphysical properties and optical properties. With the orientation toward real-time production at full spatial resolution of satellite imagers, algorithmic and computational efficiency are essential elements of the approach. The algorithm includes an option for clustering of pixels in images so that a single solution to the non-linear variational problem can be shared among similar pixels to obtain an initial estimate of cloud properties, followed by a local, linear pixel-by-pixel adjustment. The presentation will include examples of cloud retrievals from Aqua MODIS in relation to products from the CloudSat and CALIPSO active sensors, which are approximately coincident with the center of the MODIS swath.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
118.	Prof. Guosheng Liu *Florida State University*	Determining Snowfall and Snow Cloud Characteristics by A-Train Satellites	Poster	There has been so far no global estimate of snowfall. CloudSat has, for the first time, provided an opportunity for us to conduct such an estimate. The goals of the this study are two-fold - developing a global snowfall climatology and understanding the structure and microphysical characteristics of snow-producing clouds – using multiple years of A-train satellites, primarily CloudSat radar and Aqua AMSR-E radiometer data. The snowfall retrieval methodology developed in this study includes two parts: first, determining whether a radar echo corresponds to snowfall (instead of rainfall), and second, converting radar reflectivity to snowfall rate. The first part is a snow-rain threshold based on multi-decade's land station and shipboard present weather reports, and the second part is based on backscatter computations of nonspherical ice particles and in situ measured particle size distributions. Since it is difficult to perform a pixel-by-pixel validation of the snowfall retrieval, we validated the satellite-derived “snowfall climatology” with gauge-measured snowfall climatology (1943-1982) from ~140 surface stations over Canada (Walsh, 1996). Using the validated snowfall retrieval algorithms, we developed a snowfall “climatology” using 4 years of CloudSat data. The results show that in the Southern Hemisphere, there is an almost zonally orientated high snowfall zone centered around 60ºS, where both snowfall frequency and rate are high. In the Northern Hemisphere, however, heavy/frequent snowfall areas are mostly locked to geographical locations. Zonally and annually averaged snowfall rate has its maximum value around 2 mm/day,which is about one third of the zonally averaged rainfall values found in the tropics, signifying the importance of snowfall in hydrological cycle. For characteristics of snow clouds, we first classified snow clouds into several different types according to their horizontal and vertical extents. Then, their frequency of occurrence, their abundance of cloud liquid water, their contribution to surface snowfall and their typical snowfall vertical profiles are studied. An interesting finding is that cloud liquid water is abundant (100 ~ 200 g/m^2) in shallow, isolated snow clouds, while deep snow clouds associated with low pressure systems are relatively “dry” (low liquid water path) although they produce heavy snowfall.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
119.	Dr. Zhaoyan Liu *National Institute of Aerospace*	Dust event transported from East Asia to North America during April 2010	Poster	China and much of East Asia experienced a drought in the spring of 2010 that is said to be the worst in the past century. MODIS imagry indicates numerous major dust storms occurring in the Taklimakan and Gobi deserts. Intense, persistent dust was subsequently observed over North America by space-based, airborne and ground-based lidars during April 2010. Using CALIPSO lidar (CALIOP) measurements and air parcel back trajectories, we track the dust measured over North America back to East Asian source regions, and present an initial time history of dust optical properties observed by CALIOP and the Langley airborne HSRL. We also interpret the CALIOP and other A-Train observations using results from a 3D chemical transport model (GEOS-Chem) and investigate the meteorological context that gave rise to these dust storms.
120.	Norman G Loeb *NASA Langley Research Center*	Influence of Clouds and Aerosols on the Earth's Radiation Budget Through Synergistic Use of A-Train Observations	Talk	The radiative energy balance between the solar or shortwave (SW) radiation absorbed by Earth and the thermal infrared or longwave (LW) radiation emitted back to space is fundamental to climate. An increase in the net radiative flux into the system (e.g., due to external forcing) is primarily stored as heat in the ocean, and can resurface at a later time to affect weather and climate on a global scale. The associated changes in the components of the Earth-atmosphere such as clouds, the surface and the atmosphere further alter the radiative balance, leading to further changes in weather and climate. Observations clearly show large interannual and decadal variability in the Earth's radiation budget associated with the major modes of climate variability (e.g., ENSO, NAO, etc.). The complex processes governing the relationship between the atmosphere, clouds, surface properties and the radiation budget at both short and longer time-scales are poorly represented in state-of-the-art climate models. Cloud feedbacks in particular pose a significant challenge to model projections of future climate. The explosion of new high-quality data from satellite instruments in the A-Train provides an unprecedented opportunity to improve our understanding of the complex processes that influence the Earth's radiation budget. The goal of this presentation is to highlight some of the new capabilities and insights derived from A-Train data in Earth Radiation Budget research. The emphasis is on synergistic use of data from complementary A-Train instruments with a focus on clouds, aerosols and radiation. Specific topics covered include: quantifying top-of-atmosphere, surface and within-atmosphere radiation budget; cloud/radiation observations in polar regions; observing interannual variability from A-Train data; influence of thin cirrus on the Earth's radiation budget; influence of aerosols on the TOA radiation budget.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
121.	Sarah Lu *NOAA NCEP EMC*	On-line aerosol simulations in NCEP GFS and comparisons to A-Train aerosol measurements	Poster	A module for tropospheric aerosols (the Goddard Chemistry, Aerosol, Radiation, and Transport model, GOCART) has been implemented into Global Forecast System (GFS). The new on-line aerosol forecast system extends current data assimilation and forecast capabilities for numerical weather prediction at National Centers for Environmental Prediction (NCEP). It will enable NCEP to produce global short-range chemical weather forecasts, provide lateral boundary conditions for regional air quality forecast system, and create aerosol information needed for atmospheric corrections in satellite retrievals. In addition, the inclusion of prognostic aerosols in GFS provides a first step toward an aerosol data assimilation capability at NCEP. Since GFS is the AGCM of NCEP's Climate Forecast System (CFS), the new aerosol element will allow NCEP to explore aerosol-chemistry-climate interactions in the climate system. The use of aerosol measurements from the A-Train has been critical for evaluating and refining the on-line aerosol forecast system. This presentation will present online simulations of global aerosol distributions in the NCEP GFS and the comparisons to aerosol-sensitive radiative quantities from A-Train system.
122.	Prof. Yali Luo *Chinese Academy of Meteorological Sciences*	Inter-comparison of deep convection over the Tibetan Plateau-Asian Monsoon Region and subtropical north America in boreal summer using CloudSat/CALIPSO data	Poster	Properties of deep convection are first contrasted among three regions at the Tibetan Plateau-Southern Asian Monsoon Region (TP-SAMR) [i.e., TP, south slope of TP (PSS), and SAMR], and then among the three regions and East Asia (EA), East and West North America (ENA, WNA), and tropical northwest Pacific (NWP), using CloudSat products during June-August of 2006-2009. The properties investigated include occurrences of deep convection, horizontal size of convective system, internal vertical structures of deep convective clouds represented by heights of cloud top (CTH) and large precipitating top (ETH) and distance between CTH and ETH, as well as local atmospheric conditions (height of level of neutral buoyancy and total precipitable water). Averages using the CloudSat daytime and nighttime observations are presented and the day-night contrasts are discussed. Relative to PSS and SAMR, deep convection occurs less frequently over TP, with lower and more packed cloud tops and with lower ETH, inside smaller-size convective system. While the two tropical regions (NWP and SAMR) are apparently similar in many regards [higher CTH and more fuzzy tops of deep convective clouds and larger-size convective systems], general similarities are found among the subtropical continental regions (TP, EA, ENA, and WNA). The most intense deep convection appears to occur the most frequently at PSS and possesses some unique features of its own. Many findings here are consistent with those from previous studies that are based on observations with full diurnal sampling. This study adds to the previous studies by showing cloud structures associated with deep convection.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
123.	Prof. Zhengzhao Luo *City College of New York, CUNY*	Tropical deep convection from A-Train perspective: new insights	Poster	A-Train constellation presents a unique opportunity to study tropical convection. With the launch of new generation instruments, most notably CloudSat and CALIPSO, we are now able to view convection from a fundamentally new standpoint. This presentation summarizes the authors' recent work that uses synergistic measurements from the A-Train constellation to study tropical convection. Emphasis is placed upon pursuing new insights and developing new methods to advance our understanding of the tropical deep convective processes. Specifically, the following topics are presented: 1) estimating hurricane intensity, 2) investigating life cycle of penetrating convection, 3) estimating convective buoyancy and entrainment rate, and 4) demonstrating the synergistic value of AMSR-E/CloudSat/MODIS measurements in characterizing the structure of deep convective towers. Moreover, we stress that A-Train observations (like any other observations from polar-orbiting satellites) are necessarily "snapshots". To use A-Train data to study fast-evolving phenomena such as deep convection, it is important to interpret the "snapshots" in a proper context. We show that innovative analysis of A-Train data can reveal the dynamic context of the convective motions observed.
124.	Dr. Jay Mace *University of Utah*	The Merged Cloudsat-Calipso Geometrical Profile Product: Evaluation of the Post-Bug Data	Poster	One of the most obvious synergies of the Cloudsat and CALIPSO data streams arises from the ability of the lidar to sense thin and tenuous cloud layers and the ability of the radar to probe the depths of even the thickest clouds. This synergy was exploited by combining the CALIPSO Vertical Feature Mask (VFM) with the CloudSat Geometrical profile product to produce the Geoprof-Lidar data set. Early releases of this data proved compelling and quite useful in describing the vertical and horizontal distribution of hydrometeors in the Earth's atmosphere. However, an error in the CALIPSO VFM artificially enhanced the frequency of occurrence of certain boundary layer clouds. A repaired version of the VFM has been produced and incorporated into an updated release of Geoprof-Lidar. We describe the changes to the cloud occurrence statistics in the latest release and examine the perspective that four years of active remote sensing can provide on the temporal variability of hydrometeor occurrence in the Earth's atmosphere.
125.	Mr. Brent C Maddux *UW-CIMSS*	MODIS Level-3 Cloud Properties	Poster	The Moderate Resolution Imaging Spectroradiometer(MODIS) on board the Aqua platform has been making continuous measurements for more than 8 years. Globally, cloud properties have remained remarkably constant over the near decade long data record. Furthermore, the orbit of the Aqua platform has been very stable, drifting less than 10km from the original ground track and 15 minutes in local equatorial overpass time. This stability allows for the compositing of the data set around various parameters, both natural and artificial, e.g. the annual cycle or view angle. In this poster we will present the large scale view of the global cloud field from the Aqua MODIS.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
126.	Roger Marchand *University of Washington*	Spatial Correlation of Hydrometeor Occurrence, Reflectivity, and Rain Rate from CloudSat	Poster	A primary objective of the CloudSat mission is to provide global observations of cloud and precipitation structure that can be used in the analysis of global climate models. To that end, CloudSat observations are being used to construct joint histograms of radar reflectivity with height (Marchand et al. 2009). CloudSat observations contain much more information on the structure of cloud fields then is captured in these simple histograms. The histograms are single-point statistics. One could arbitrarily reorder the radar profiles in any sequence (destroying all along-track or horizontal correlation) or shift the observed reflectivity at a given height an arbitrary distance relative to the layer above or below (destroying vertical correlation) and obtain the same reflectivity-height joint histogram. The two-dimensional transects observed by CloudSat can also be used to construct two (or higher) point statistics. In this presentation we will examine some simple two-points statistics, including vertical and horizontal correlation in hydrometeor (cloud and precipitation) occurrence, reflectivity, and rain rate over-ocean. We will show how these statistics vary over the globe. Marchand, R., J. Haynes, G. G. Mace, T. Ackerman, and G. Stephens (2009), A comparison of simulated cloud radar output from the multiscale modeling framework global climate model with CloudSat cloud radar observations, J. Geophys. Res., 114, D00A20, doi:10.1029/2008JD009790.
127.	Dr. Benjamin Marchant *NASA/GEST*	Development of Cloud Thermodynamic Phase Retrievals for MODIS Collection 6: Comparison with CALIOP and POLDER Phase Retrievals	Poster	Determination of cloud thermodynamic phase retrieval is an important first step in processing MODIS cloud optical products. Since water and ice particles have very different scattering and absorption properties, an incorrect phase determination can lead to substantial errors in retrieved cloud optical thickness and/or effective particle radius. There are currently two different inferences of cloud phase in the MODIS Collection 5 cloud products based on: (1) bispectral IR tests, and (2) a “decision tree” that combines the IR bispectral result with shortwave IR (SWIR) and cloud mask tests. The latter is used in processing MODIS cloud optical properties. These phase tests present a number of shortcomings, especially for optically thin cirrus, multilayered clouds (such as thin cirrus over lower-level water clouds), mixed phase clouds, and single layered clouds at supercooled temperatures. To improve cloud thermodynamic phase retrievals for the next MODIS Collection 6, a new algorithm is under development. The main idea is to replace SWIR tests based on thresholds of ratios between SWIR and VIS/NIR reflectances with thresholds based on separate ice and liquid cloud effective size retrievals in different SWIR spectral bands. In order to develop and optimize these new thresholds, we use geolocated data sets that merge products from the MODIS, CALIOP and POLDER sensors. In addition, the merged data set provides the means to better quantify the new algorithm’s performance. We will report initial results from analysis of the data set in terms of MODIS spectral effective radii retrievals.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
128.	Dr. Alexander Marshak *NASA GSFC*	What have we learned from MODIS and CALIPSO about aerosol properties in the vicinity of clouds?	Poster	One of the primary science objectives of the CALIPSO and MODIS missions is to quantify the direct and indirect aerosol radiative forcings and their uncertainties. In order to correctly assess these forcings, it is essential to understand the variability of aerosol properties in the vicinity of clouds. This is especially important since aerosol properties are substantially different in cloud-free and partly cloudy regions, and also because there is a strong correlation between aerosol optical depth and cloud cover. However, the interpretation of satellite aerosol observations is particularly challenging in partly cloudy environments due to issues such as cloud contamination and cloud adjacency effects. Together, CALIPSO and MODIS are uniquely well suited for studying aerosols near clouds not only because they provide a global dataset on aerosol and cloud properties and they complement each other's information content, but also because they are affected (and not affected) by different remote sensing problems. We discuss the efforts of our group at NASA GSFC on better understanding the effects of clouds on aerosol properties and aerosol direct radiative forcing using CALIPSO and MODIS/Aqua observations, and on improving the interpretation of MODIS aerosol observations near clouds with the help of CALIPSO (CALIOP and WFC) and CERES data and our existing models of cloud adjacency effects.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
129.	Dr. J. Vanderlei Martins *University of Maryland Baltimore County*	PACS - A New Wide FOV, Hyperangular, Imaging Polarimeter for Aircraft and Space Measurements of Aerosols and Clouds	Poster	The climate community requires new observations and better understanding of aerosol and cloud processes to narrow uncertainties on estimates of climate change. Following the EOS era, a new generation of space sensors is needed for the detailed measurement of aerosol and cloud properties. The French Polder instrument currently flying in the A-Train, and the APS (Aerosol Polarimetric Sensor) soon to be launched on the Glory satellite have started a new trend of multi-angular polarization measurements from space. Polder has limited accuracy, coarse spatial resolution, and narrow wavelength range. APS is highly accurate and covers a broad wavelength range (410-2250nm) but lacks in spatial resolution (~7km at nadir) as well as on the ability to produce a cross track image since it relies in a single cross-track pixel. The Passive Aerosol and Cloud Suite (PACS) contains an accurate imaging polarimeter with 110deg cross-track swath (allowing near global coverage from space), hyper-angular capability with over 60 angles in selected wavelengths, broad wavelength range possibilities, and potential for high spatial resolution. PACS meets all requirements of the imaging polarimeter described by the NRC Decadal Survey for the Aerosols-Clouds-Ecosystems (ACE) mission. Highly capable, small and versatile, PACS can provide unprecedented retrievals of aerosol and cloud properties, offering new insight into important atmospheric processes that influence climate change. The first generation of the PACS polarimeter has been built and is being tested for VNIR wavelengths from 470-865nm. Preliminary results will be shown to demonstrate the PACS multi-angle imaging capabilities and highly accurate polarization measurements in wide cross track FOV.

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130.	Dr. J. Vanderlei Martins *University of Maryland Baltimore County*	PACS - A New Wide FOV, Hyperangular, Imaging Polarimeter for Aircraft and Space Measurements of Aerosols and Clouds	Poster	The climate community requires new observations and better understanding of aerosol and cloud processes to narrow uncertainties on estimates of climate change. Following the EOS era, a new generation of space sensors is needed for the detailed measurement of aerosol and cloud properties. The French Polder instrument currently flying in the A-Train, and the APS (Aerosol Polarimetric Sensor) soon to be launched on the Glory satellite have started a new trend of multi-angular polarization measurements from space. Polder has limited accuracy, coarse spatial resolution, and narrow wavelength range. APS is highly accurate and covers a broad wavelength range (410-2250nm) but lacks in spatial resolution (~7km at nadir) as well as on the ability to produce a cross track image since it relies in a single cross-track pixel. The Passive Aerosol and Cloud Suite (PACS) contains an accurate imaging polarimeter with 110deg cross-track swath (allowing near global coverage from space), hyper-angular capability with over 60 angles in selected wavelengths, broad wavelength range possibilities, and potential for high spatial resolution. PACS meets all requirements of the imaging polarimeter described by the NRC Decadal Survey for the Aerosols-Clouds-Ecosystems (ACE) mission. Highly capable, small and versatile, PACS can provide unprecedented retrievals of aerosol and cloud properties, offering new insight into important atmospheric processes that influence climate change. The first generation of the PACS polarimeter has been built and is being tested for VNIR wavelengths from 470-865nm. Preliminary results will be shown to demonstrate the PACS multi-angle imaging capabilities and highly accurate polarization measurements in wide cross track FOV.
131.	Steven T Massie *NCAR*	Cirrus heating and cooling rates	Poster	The temporal and spatial distributions of cirrus in the upper troposphere can be specified in detail on a monthly basis from analysis of HIRDLS, CALIPSO, and CLOUDSAT cloud observations. This is especially noteworthy for subvisual cirrus, i.e. cirrus that has a small vertical depth and which is isolated from deep convection. We use observed geographical distributions of cirrus in radiative transfer calculations to calculate cirrus heating and cooling rates. Inputs to the radiative transfer calculations include cloud effective radii and ice water content data. We discuss issues associated with these inputs and discuss how their uncertainties impact the heating and cooling rate calculations.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
132.	Dr. Sergey Y Matrosov *CIRES University of Colorado and NOAA ESRL*	CloudSat observations of precipitation over the ARM Southern Great Plains site	Poster	The spaceborne W-band (94 GHz) radar onboard the CloudSat polar orbiting satellite offers new opportunities for retrieving parameters of precipitating cloud systems. CloudSat measurements can resolve the vertical cross sections of such systems. The radar bright band features, which are commonly present when observing stratiform precipitating systems, allow the vertical separation of the ice, mixed and liquid precipitating hydrometeor layers. In this study, the CloudSat data are used to simultaneously retrieve ice water path (IWP) values for ice layers of precipitating systems using absolute radar reflectivity measurements, and mean rainfall rates, Rm, in the liquid hydrometeor layers using the attenuation-based reflectivity gradient method. The retrievals were performed for precipitating events observed in the vicinity of the Southern Great Plains (SGP) Atmospheric Radiation Measurement (ARM) Climate Research Facility. The retrieval results indicated that IWP values in stratiform precipitating systems vary from a few hundreds of g m-2 up to about 104 g m-2, while the mean rain rates were in a general range between 0.5 and about 12 mmh-1. On average, mean rainfall increases with an increase in ice mass observed above the melting layer; The corresponding mean correlation coefficient is about 0.35, although events with higher correlation as well as those with no appreciable correlation were observed. Horizontal advection, wind shear and vertical air motions might be some of the reasons for decorrelation between IWP and Rm retrieved for the same vertical atmospheric column. A mean statistical relation between IWP and Rm derived from CloudSat retrievals is in good agreement with the data obtained from multi-wavelength ground-based cloud radar measurements at the SGP site.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
133.	Ms. Shana Mattoo *SSAI/NASA*	Demonstration of pixel size effects on availability of aerosol retrievals using new MODIS cloud products within the aerosol retrieval algorithm	Poster	Beginning with Collection 006, the MODIS aerosol algorithm will begin to make available several new cloud products. These include two products at 500 m resolution: a binary cloud mask and the distance to the nearest cloud for every 500 m pixel determined to be cloud free. We will also produce a 10 km product giving the average distance to the nearest cloud of every 500 m pixel within the 10 km box. While we anticipate many applications of these new products for cloud-aerosol interaction studies, here we show an immediate application as we examine the consequences of degrading pixel size. MODIS makes use of relatively small pixel size to retrieve aerosol near clouds, water and snow. As pixel size increases 1 of 2 things will happen. (1) Availability of retrievals decreases (2) Contamination of the aerosol product. Using the 500 m cloud mask product we consider an 8 km product size and degrade inherent sensor pixel size from 0.5 km to 1 km to 2 km and finally 4 km. If one of the 500 m pixels within the degraded sensor pixel was labeled “cloudy” by the original maks, the degraded pixel is labeled “cloudy”. If at least one pixel remains after masking, then make a retrieval. Applying this methodolgy globally for one day we find that the standard 0.5 km resolution retrieves in 40% of the possible 8 km product boxes. As sensor pixel size degrades, the number of retrievals are reduced. At 4 km we are retrieving only 13% of the boxes. Individual granules can be worse and entire aerosol events can be lost. Other statistical tests point out seasonal and regional differences, but globally, 50% of all cloud-free pixels are within 2 km of a cloud. Over the U.S. land, 50% of all cloud-free pixels are within 1.5 km of a cloud. The potential cloud contamination is more difficult to assess. Based on an extrapolation of an examination of subpixel clouds using Landsat imagery we set an upper bound on cloud contamination of about 0.08 AOD if degrading sensor pixel size to 4 km. This upper bound would be mitagated with better cloud masking, at the expense of losing retrievals, as explained previously.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
134.	Mr. Alexander V Matus *Texas A&M University*	A Preliminary Study on the Variability of AIRS Radiances with Cloud Type	Poster	Satellite measurements of infrared radiance spectra provide valuable information regarding the macrophysical and microphysical properties of clouds. Several studies have demonstrated that observed radiance spectra may be replicated in radiative transfer calculations through a combination of assumptions, including cloud height, optical thickness, particle size, and particle shape. What is not well known, though, is the natural variability of cloudy-sky infrared spectra. In this poster, we will show preliminary results describing the statistics of infrared radiance spectra with respect to cloud type. A statistical analysis will be made using a MEaSUREs dataset of co-located AIRS atmospheric profile retrievals, AIRS radiances, and CloudSat cloud scenario. The combination of AIRS and CloudSat provides complimentary spectral, spatial, and vertical cloud profile information. A better understanding of how cloud properties affect natural variability of cloudy-sky infrared spectra will lead to more realistic cloud property retrieval assumptions and models.
135.	Dr. Emily McCarthy *NRL*	Applying volcanic cloud retrievals to characterize pyro-convective clouds in the upper troposphere and lower stratosphere using the A-Train	Poster	Satellite-based remote sensing techniques have long been used to study volcanic clouds and biomass burning. Remote sensing of biomass burning has primarily focused on tracking aerosol clouds and quantifying carbon species. However, because volcanic eruptions and large biomass fires transport other similar gases (water vapor and, to a lesser extent, sulfur dioxide) and aerosols to the upper troposphere and lower stratosphere, retrieval methods for volcanic emissions can be applied to pyro-convective clouds (pyroCbs). The A-Train provides a suite of sensors that may be used further characterize pyroCbs. Quantification of gases and aerosols will mainly be carried out using AIRS. Given its high spectral resolution, it is possible to quantify a variety of species concurrently. The OMI Aerosol Index has proven to be critical in tracking pyroCbs, as the water vapor component is difficult to distinguish from meteorological clouds without complementary data. The MLS water vapor product will be used for validation of the AIRS water vapor retrieval and CALIPSO and CloudSat provide information on cloud height and thickness. Presented here are the results of water vapor retrievals for pyroCbs from Russian fires (summer 2010), the volcanic eruptions of Manam (October 2004-January 2005), and the ancillary data used to help track the water cloud.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
136.	Prof. Michael P McCormick *Hampton University*	Characterization of Cirrus and Polar Stratospheric Clouds	Poster	Measurements from launch to the present made by the lidar aboard the Earth-orbiting Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite are used to investigate the global and temporal characteristics of cirrus clouds and polar stratospheric clouds (PSCs). Few instruments can detect cirrus clouds on a global scale, especially those of low optical thickness. Our study shows that multi-layer cirrus clouds have a maximum occurrence frequency of up to 73.2% near the tropics over the 100° - 180° longitude band, and that there is a difference between the occurrence frequencies of cirrus clouds measured during daytime and nighttime. Also, we show the zonal mean distributions of cirrus layer top altitudes and base altitudes for nighttime and daytime. We conclude that cloud top altitudes from the nighttime data were higher than the daytime top altitudes on average by 0.6 km. We investigate the time series of the cirrus frequency and observe large latitudinal movement of cirrus cloud cover with the changing seasons. With respect to PSCs, there are few remote sensors capable of retrieving their vertical and spatial distribution over the poles during local winter and early spring periods. We study the statistical distribution of PSCs by particle composition using the depolarization ratio and backscatter ratio from the CALIPSO lidar data at 532 nm wavelength for the 2006-2010 polar winter seasons. This talk will describe the above cloud data in detail and make comparisons with other data sources and publications.
137.	Dr. Kerry Meyer *UMBC/NASA GSFC*	Cirrus cloud optical thickness retrievals from the MODIS 1.38 μm channel: Results, uncertainties, and comparison with CALIPSO	Poster	Thin cirrus are often difficult to detect, and their optical properties difficult to retrieve, using passive sensors such as the Moderate-resolution Imaging Spectroradiometer (MODIS). Indeed, the MODIS cloud products (MOD06) often fail to retrieve such clouds. To potentially improve upon the capabilities of these products, a new pixel-level optical thickness retrieval method, employing the MODIS 1.38 μm channel, has been developed for single-layer thin cirrus conditions. The 1.38 μm channel, centered within a strong water vapor absorption band, is quite sensitive to cirrus, or more specifically, to cirrus optical thickness. However, its signal suffers non-negligible attenuation due to atmospheric water vapor above and within the cloud. This attenuation can be accounted for by pairing 1.38 μm with a window channel, namely 1.24 μm. After correcting for attenuation, cirrus optical thickness is derived from 1.38 μm reflectance using a look-up table approach. The capability of this method is demonstrated with retrieval results for several Aqua MODIS case studies. Additionally, baseline uncertainty estimates for each case are presented. Finally, the MODIS retrieval results are compared with collocated CALIPSO version 3 level 2 5 km cloud layer optical thickness retrievals.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
138.	Mr. Tero Mielonen *Finnish Meteorological Institute*	Evaluating the assumptions of surface reflectance and aerosol type selection within the MODIS aerosol retrieval over land: The problem of dust type selection	Poster	Aerosol Optical Depth (AOD) and Ångström exponent (AE) values derived with the MODIS retrieval algorithm over land (Collection 5) were compared with ground based sun photometer measurements in Europe, Asia, Africa North America and South America. In Finland (Jokioinen and Sodankylä) measurements were done with Precision Filter Radiometer (PFR), while in Estonia (Toravere), Italy (Ispra, Rome Tor Vergata), India (Kanpur), China (Xianghe), GSFC (USA), Mexico (Mexico City), Zambia (Mongu) and Brazil (Alta Floresta) Cimel (AERONET, level 2) measurements were used. Comparison results for AOD were generally good, although there seems to be room for improvement in the MODIS aerosol model selection, particularly how dust is taken into account. At all studied sites, the MODIS algorithm often selects the dust aerosol model even when dust does not seem to be present and the air masses are not coming from arid regions. This happens especially when AOD values are relatively small (< 0.3). The selection of the dust model reduces the correlation between ground based and MODIS AOD measurements in dust-free situations. Moreover, the current aerosol model selection scheme produces unphysical AE values. Our study suggests that the aerosol model combining is sensitive to the ratio of 660 nm and 2130 nm surface reflectances (slope(660/2130)). Furthermore, the value of the slope in the algorithm is mainly dependent on the Normalized Difference Vegetation Index (NDVI). The current relationship of these two parameters in the algorithm is not supported by the surface albedo climatology derived from MODIS measurements. The use of a more physical relationship improves the AE retrieval at the studied sites. However, at some sites the AOD correspondence deteriorates when the new relationship is used.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
139.	Dr. Patrick Minnis *NASA Langley Res Ctr*	Improving CERES Cloud Retrieval Algorithms Using CALIPSO and CloudSat Data	Poster	Validating cloud retrieval algorithms based on passive satellite imager data has been very difficult for lack of cloud truth data. Defining the limits of cloud cover in both the horizontal and vertical coordinates has traditionally depended on visual observations at certain land-based locations around the world and on a very limited array of fixed site active remote sensors. Thus, objective "truth" data is unavailable for most of the Earth. The combination of CloudSat radar and CALIPSO lidar provides objective truth data for the entire globe, at least, for two local times each day. This represents a significant step in the effort to validate passive satellite cloud retrievals. This paper reports on the validation of Clouds and the Earth's Radiant Energy System (CERES) Edition-2 cloud retrieval data using CALIPSO and CloudSat data and the use of that same data to develop improvements that will be implemented in the CERES Edition-4 cloud products that will become available early in 2011. The algorithm enhancements based on the comparisons of CERES and the active A-Train sensor cloud data include better cloud detection, improved height specification, more accurate cloud thickness estimation, multilayered cloud retrievals, and nighttime optical depth estimates. The improvements will be reviewed and differences with older and later versions of the CALIPSO code will be discussed.
140.	Dr. Guillaume Mioche *LaMP*	Comparisons between CloudSat products and in situ observations. Part II : mixed-phase cloud characterization.	Poster	In order to validate new space remote sensing observations numerous validation plans took place including in situ airborne measurements co-located with the satellite tracks. In this context, the ASTAR-2007 and POLARCAT-2008 airborne campaigns were carried out respectively in Arctic regions near Spitzbergen in April 2007 and in Northern part of Sweden in April 2008 to experience mixed-phase clouds. The CIRCLE-2 campaign was carried out in Western Europe in May 2007 to sample mid-latitude cirrus clouds. The main objectives of these field projects were the characterization of microphysical and optical properties of mixed-phase and ice clouds with particular interest on the validation of clouds products derived from CloudSat and CALIPSO data during co-located remote and in situ observations. The airborne microphysical instruments included the Polar Nephelometer probe, the high resolution Cloud Particle Imager (CPI) and standard PMS 2D-C and FSSP-100 instruments. The part II of the poster focuses on results obtained in mixed-phase clouds. They concern the comparison of the standard parameter of the Cloud Profiling Radar (CPR) of CloudSat (equivalent radar reflectivity factor Z) with the reflectivity factor deduced from quasi co-located cloud in situ measurements. The retrieved microphysical cloud parameters (LWC/IWC, Reff and particle concentration) from CloudSat algorithms are then compared with in situ observations. The results are then discussed to assess the reliability of the parameterizations for both water cloud phases (water droplets and ice crystals).

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

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141.	Ms. Brandie S Mitchell *NASA DEVELOP Program*	Using NASA EOS to Assess the Impact of Sugar Cane and Marsh Burning Practices on Local Air Quality	Poster	ASTER, Landsat, and MODIS data products were employed to assess the impact of sugar cane and marsh burning practices on local air quality in coastal Louisiana. Biomass burning is an event that occurs globally due to manmade and natural fires. About 3 billion metric tons of biomass are burned every year worldwide [Curtis, 2002]. Societies have used fire for cooking and heating, clearing land for agricultural use, and removing excess biomass from grazing and crop lands [Levine, 1991]. This study focuses on the state of Louisiana and its commonly occurring methods of sugarcane and marsh biomass burning [LSU Ag. Center 2000; Nyman and Chabreck 1995]. Over the centuries, the Louisiana sugarcane industry has grown to surpass all other agriculture commodities. To promote efficiency in this large industry, burning excess biomass takes place throughout the harvesting period [LSU Ag. Center, 2000]. In addition to sugarcane, Louisiana contains 30% of the total coastal marsh of the United States [LSU Ag. Center, 2000]. The periodic burning of marshland is an ecologically important management tool that is practiced throughout the Atlantic and Gulf Coasts [Nyman and Chabreck, 1995]. In most biomass burning events, one of the leading by-products is particulate matter less than 10 microns in diameter (PM10). Through past research, this fine material has been shown to have negative health effects on surrounding human populations [Boopathy, 2001]. Voluntary burning guidelines have been set into place by the Louisiana Department of Agriculture and Forestry (LDAF) to reduce health effects [LSU Ag. Center, 2000]. To help quantify emission estimates, we focused on Iberia Parish for sugarcane burning and Cameron Parish for marsh burning. Through ASTER, Landsat 5 TM, and MODIS data, we estimated the amount and location of land area burned for select parishes for the years 2008 and 2009. With emissions algorithms from Seiler and Crutzen, 1980, total acreage burned can be used to estimate emissions. This information will help to document the impact of these smoke plumes on local populations and may help to improve biomass burning policies in Louisiana.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

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142.	Ms. Brandie S Mitchell *NASA DEVELOP Program*	Detection of Natural Oil Seeps in the Atlantic Ocean using MODIS	Poster	Natural oil seepage is the release of crude oil into the ocean from fissures in the seabed. Oil seepage is a major contributor to the total amount of oil entering the world's oceans. According to a 2003 study by the National Academy of Sciences (NAS), 47 percent of oil entering the world's oceans is from natural seeps, and 53 percent is from human sources (extraction, transportation, and consumption). Oil seeps cause smooth oil slicks to form on the water's surface. Oil seeps can indicate the location of stores of fossil fuel beneath the ocean floor. Knowledge of the effect of oil seepage on marine life and marine ecosystems remains limited. In the past, remote sensing has been used to detect oil seeps in the Gulf of Mexico and off of the coast of southern California. This project utilized sun glint MODIS imagery to locate oil slicks off of the Atlantic coast, an area that had not previously been surveyed for natural oil seeps using remote sensing. Since 1982, the Atlantic Ocean has been closed to any oil and gas drilling. Recently, however, the U.S. Minerals Management Services (MMS) has proposed a lease for oil and gas drilling off the coasts of Virginia and North Carolina. Determining the location of seepage sites in the Atlantic Ocean will help MMS locate potential deposits of oil and natural gas, thereby reducing the risk of leasing areas for petroleum extraction that do not contain these natural resources.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
143.	Gyula I Molnar *GEST/UMBC/NASA-GODDARD*	Recent Spatial and Temporal Anomalies and Trends of OLR as Observed by CERES and Computed Based on AIRS Retrievals	Poster	We show that a recent CERES-observed negative trend in OLR of ~-0.1 W/m2/yr averaged over the globe, for the time period of September 2002 through February 2010 used in this study, is found in the AIRS OLR data as well. Most importantly, even minute details (down to 1 x 1 Degree GCM-scale resolution) of spatial and temporal anomalies and trends of OLR as observed by CERES and computed based on AIRS-retrieved surface and atmospheric geophysical parameters over this time period are essentially the same. We see this correspondance even in the very large spatial variations of these trends with local values ranging from -2.6 W/m2/yr to +3.0 W/m2/yr in the tropics. This essentially perfect agreement of OLR anomalies and even local trends derived from observations by two different instruments, in totally independent and different manners, implies that both sets of results must be highly accurate; and indirectly validates the anomalies and trends of other AIRS derived products as well. These products show that global and regional anomalies and trends of OLR, water vapor and cloud cover over the last 7+ years are strongly influenced by El-Niño-La Niña cycles. We use the anomalies and trends of AIRS derived products to explain why the global OLR has a large negative trend over this time period; Global and tropical OLR began to decrease significantly at the onset of a strong La Niña in mid-2007. AIRS products show that cloudiness and mid-tropospheric water vapor began to increase in the tropics at roughly the same time, especially in the region 5°N - 20°S latitude extending eastward from 150°W to 30°E longitude, with a corresponding very large drop in OLR in this region. Late 2009 is characterized by a strong El-Niño, with a corresponding change in sign of observed tropical water vapor, cloud cover, and OLR anomalies. If one excludes the area 5°N – 20°S, 150°W – 30°E from the statistics, area mean OLR trends over the rest of the globe are substantially reduced over the time period under study.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
144.	Ms. Rachel M Moore *NASA Goddard Space Flight Center*	Maryland Ecological Forecasting: Application of NASA Observational Data and Habitat Suitability Modeling for the Control of Wavyleaf Basketgrass	Poster	Wavyleaf basketgrass (WLBG) is a highly invasive exotic grass species. It was first found in the United States in 1996, in the Patapsco Valley State Park of Maryland. The initial population comprised several large patches, each up to 15m in diameter (Peterson, 1999). A return trip to the site of initial discovery in 2007 revealed that the the original 15m patches had increased to diameters of up to 150m, scattered across more than 1000 acres of forest (Kyde, 2010). This shade tolerant, perennial plant is extremely aggressive when invading a forest area. It outcompetes native grasses, shrubs plants, and hardwood trees, forming a dense monoculture that covers forest floors. It is estimated that this species could invade and destroy as much as 10% of the forests in the eastern quarter of the United States in the next decade (Imlay, 2010). The Maryland Department of Natural Resources (MD DNR) has been gathering presence/absence data for WLBG in order to create distribution maps. The circumstances surrounding WLBG provide a unique opportunity to evaluate the effectiveness of NASA's Invasive Species Forecasting System (ISFS). The ISFS provides computational support for regional-scale ecosystem modeling applications. ISFS has been designed to help resource managers understand the potential distribution of invasive terrestrial plant species. The ISFS will be used to "shadow" the WLBG mapping work of MD DNR ecologists to produce comparative ISFS-based predictive habitat suitability models and maps for the species. MD DNR field sample data for WLBG will be used as input data, as well as NASA satellite data and other environmental layers. In addition to the ISFS's predictive maps, the work will result in an ISFS-based decision support system prototype tailored to WLBG and the specific needs of MD DNR ecologists and resource managers. These products will provide the basis for evaluating the overall effectiveness and usability of ISFS to WLBG early detection and rapid response.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
145.	Prof. Sonoyo Mukai *Kinki University*	Retrieval algorithms from space for heavy aerosol events	Poster	In this study we focus on aerosol retrieval in the heavy events, which indicate too much loading of aerosols in the atmosphere such as dust storm and biomass burning. Recently large scale-forest fire, which damages the Earth environment as biomass burning and emission of carbonaceous particles, frequently occurs due to the unstable climate and/or global warming tendency. It is also known that the heavy soil dust is transported from the China continent to Japan on westerly winds, especially in spring, and provides us with severe damages on the social life and/or human health. Furthermore the increasing emissions of anthropogenic particles associated with continuing economic growth scatter serious air pollutants. Thus atmospheric aerosols in Asia are very complex and heavy loading. It is natural to consider that incident solar light multiply interacts with the atmospheric aerosols due to dense radiation field in the aerosol event, that is to say the optical thickness of Earth atmosphere increases too much to do sun/sky photometry from surface-level. However the space-based observations are available for monitoring the atmospheric aerosols even in the heavy aerosol events. Here retrieval algorithms from space for such aerosol events are proposed. In practice, appropriate index for detection of dust storm or biomass burning plume, diagnostic method of core part of the aerosol event, and simulation code of radiative transfer for semi-infinite atmosphere model are newly developed. The retrieved results of aerosol characteristics are validated with ground-based measurements and/or model simulations. In this work, the space- or surface-based measurements, multiple scattering calculations and model simulations are synthesized together for aerosol retrieval.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
146.	Prof. Takashi Nakajima *Tokai University*	Cloud particle growth process observed from A-Train	Talk	The IPCC 4th assessment report pointed out that aerosols, clouds, and their interaction processes represent large uncertainties in climate change projections. Thus, it is important to measure the global distribution of aerosols and clouds and their optical and microphysical properties and it is also important to reveal the processes by which cloud droplets grow and transition to rain. These processes lie at the core of our understanding of the so-called aerosol indirect effect and also at the core of our understanding of cloud feedback in the radiation budgets. In order to observe aerosols and clouds, many sensors aboard satellites, aircrafts, and ground segments have been developed in the past thirty years. And many valuable datasets have been obtained from these observation systems. One of the features of recent existing and/or planning missions is installation of active sensors such as radar and lidar that enable us to observe vertical structure of cloud and aerosol. These new observation systems are developed for the purpose of revealing not only the horizontal distribution of aerosols and clouds but also the mechanism of particle transition, e.g. from cloud condensation nuclei to rain droplets, by estimating the vertical structure of aerosol and cloud layer. For example, spaceborne radar reflectivities (CloudSat) classified by cloud effective radii obtained from passive spaceborne imager (MODIS) shows transition of cloud growth, from cloud droplet mode to rain mode via drizzle mode, very clearly. Now, we may realize an important fact, that the science communities will demand more accurate observation results with high consistency between observations and models, so that the collaborative work between observations and models become more important task. In this presentation, we will talk about recent progresses of the cloud observations from A-Train, showing a multi-sensor view (MODIS and CloudSat) of cloud droplet growth process and some radiative transfer simulations. We also mention about possible contributions to the next generation satellite mission, EarthCARE, GCOM-C, and so on.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
147.	Prof. Shaima L Nasiri *Texas A&M University*	Cloud Phase Determination Using AIRS and Evaluation with CALIPSO V3 Cloud Layer Products	Poster	Cirrus cloud optical thickness and particle size retrieval algorithms have been proposed that make use of the strong sensitivity of infrared radiance spectra to cirrus microphysical properties. Because IR radiance spectra typically show more sensitivity to ice clouds than to water clouds, identifying which scenes contain ice clouds is important. In this presentation, we will describe a new method of detecting ice clouds in data from the Atmospheric Infrared Sounder (AIRS) on the Aqua satellite. We have used radiative transfer calculations to identify a set of AIRS channel combinations in the infrared window region, such as the BTD between channels 960 cm-1 and 1231 cm-1, that show phase sensitivity. Utilizing this set of BTDs, we have developed a computationally fast ice cloud detection algorithm that also includes information from the AIRS Level 2 effective cloud fraction and UW-Madison MODIS baseline fit global land surface emissivity. In this study, we will show the results of applying the AIRS cloud phase algorithm to one month of data along the CALIPSO track. These results will be evaluated with respect to the AIRS Level 2 retrievals of effective cloud fraction and CALIPSO/CALIOP V3 1-km cloud-layer retrievals of layer-integrated depolarization ratio, layer-integrated attenuated backscatter at 532 nm, mid-layer cloud temperature, and cloud thermodynamic phase.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
148.	Dr. Catherine M Naud *Columbia University/GISS*	Cloud vertical distribution in extratropical cyclones	Poster	Using two consecutive winters of CloudSat-CALIPSO observations, NCEP-2 reanalysis atmospheric state parameters over the northern and southern hemisphere oceans (30º-70º N/S) between November 2006 and September 2008, and an automated front detection algorithm, we examined how clouds are distributed along the vertical across warm and cold fronts in extratropical cyclones. These distributions generally resemble those from the original model introduced by the Bergen School in the 1920s, with the following exceptions: (1) Substantial low cloudiness which is present behind and ahead of the warm and cold fronts; (2) Ubiquitous high cloudiness, some of it very thin, throughout the warm-frontal region; (3) Upright convective cloudiness near and behind some warm fronts. One winter of GISS general circulation model simulations of fronts at 2ºx2.5ºx32L resolution gave similar cloud distributions but with much lower cloud fraction, a shallower depth of cloudiness, and a shorter extent of tilted warm-frontal cloud cover in the cold sector. A close examination of the relationship between the cloudiness and relative humidity fields indicated that upward transport of water vapor is too weak in modeled midlatitude cyclones, and this is related to weak vertical velocities in the model. The model also produced too little cloudiness for a given value of vertical velocity or relative humidity. For global climate models run at scales coarser than tens of kilometers, we suggest that the current underestimate of modeled cloud cover in the storm track regions, and in particular the 50º-60ºS band of the southern oceans, could be reduced with the implementation of a slantwise convection parameterization. This parameterization is being developed and preliminary tests are conducted using the NASA-GISS model E.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
149.	Dr. Tomoaki Nishizawa *National Institute for Environmental Studies, Japan*	Development of multiwavelength High-Spectral Resolution Lidar	Poster	A multiwavelength High Spectral Resolution Lidar (HSRL) system for the next-generation aerosol observation lidar network has been developed. The HSRL system is adopted in order to realize highly sensitive and independent extinction measurements and to enable advanced classification and retrieval of aerosols. This lidar system provides extinction coefficients (α) at 355 and 532nm; backscatter coefficients (β) at 355, 532, and 1064nm; and linear depolarization ratios (δ) at 532 and 1064nm. It combines the use of the previously developed HSRL techniques with an iodine absorption filter for 532nm and a Fabry-Perot etalon for 355nm. A system to automatically tune the laser wavelength to an iodine absorption line and to tune the etalon transmittance wavelength to the tuned laser wavelength in this lidar system is also developed in order to realize long-term continuous measurements. In the presentation, we will introduce this multiwavelength HSRL, report the latest status of this lidar system development, and present data actually measured with this system. We will further present our strategy for aerosol retrieval using this multichannel lidar data.
150.	Dr. Tomoaki Nishizawa *National Institute for Environmental Studies, Japan*	Aerosol classification retrieval algorithms using 1α+1β+1δ data of ATLID/EarthCARE and 2β+1δ data of CALIOP	Poster	EarthCARE (Earth Clouds, Aerosols and Radiation Explorer) is a joint Japanese (JAXA)-European (ESA) satellite observation mission for understanding the interaction between clouds, radiative and aerosol processes in the earth climate. Four sensors that are cloud profiling radar (CPR), multi-spectral imager (MSI), broadband radiometer (BBR), and high spectral resolution lidar (ATLID), will be installed on the EarthCARE satellite. In order to understand the global distribution of aerosol components, we have developed an algorithm to classify water-soluble, dust, and black carbon components and to retrieve their extinction coefficients in each layer using all the three-channel data of ATLID (i.e., extinction coefficient α, backscatter coefficient β, and depolarization ratio δ of particles at 355nm). We have also developed an algorithm to retrieve the vertical profiles of extinction coefficients of water-soluble, dust, and sea-salt components using 2β (1064, 532nm)+1δ (532nm) lidar data from CALIOP and NIES ground-based network lidar measurements. To reduce unknown parameters in the retrieval, the mode radii, standard deviations, and refractive indexes for each aerosol component are prescribed in the algorithms based on previous studies; dust is assumed to be spheroidal, and the other components are assumed to be spherical. In the presentation, we will demonstrate the performance of the algorithms by applying ground-based high spectral resolution lidar and Mie-scattering lidar data and CALIOP data.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
151.	Dr. Vincent Noel *LMD/IPSL/CNRS*	Investigating the consequences of the 2010 eruption of the Eyjafjallajokull volcano for cloud cover and properties over Europe	Poster	The transformation of aircraft contrails in cirrus clouds has been observed repeatedly during the last half-century. Exhaust from jet aircraft turbines in air supersaturated with respect to ice leads to the nucleation of ice crystals. In the right atmospheric conditions, this triggers the fast formation of ice clouds on hourly timescales. There is still much uncertainty about the impact contrails have on the population of clouds on a global or regional scale, and, thus, on their radiative impact; studies suggest that on a local scale contrails can decrease the ground diurnal temperature variation by as much as 1 degree. The eruption in spring 2010 of the islandic volcano Eyjafjallajokull released ashes several kilometers in the atmosphere, leading to a disruption of the air travel over the most part of Western Europe, as well as to and from the United States. Most notably, almost all European aircraft traffic was grounded during a six-day period beginning April 15, 2010. This event created a contrail-free period over Europe, which can be used as a basis to evaluate their potential impact on the cloud population. We analyzed the spatial distribution of thermodynamic variables in the 2006-2010 spring period in order to find synoptic situations similar to the one observed during the air traffic shutdown period. We then analyzed CALIOP observations to evaluate the deviation in cloud cover and properties during the air traffic shutdown compared to similar synoptic situations during the previous years. Variations in cloud cover, optical depth, geometrical thickness, and optical properties will be presented over Europe and the Atlantic Ocean.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
152.	Dr. Peter M Norris *NASA/GSFC, UMBC/GEST*	Using MODIS, CloudSat and CALIPSO observations to constrain a statistical cloud parameterization in the NASA GEOS-5 GCM	Poster	A-Train observations contain a rich set of information on statistical cloud variability within a typical GCM-sized gridcolumn. MODIS provides high horizontal resolution passive estimates of cloud top pressure (5km) and optical depth (1km). CloudSat and CALIPSO provide relatively high vertical resolution (240m and 60m) active estimates of the optical extinction profile in a curtain with a high along-track resolution (1.7km and 5km). We use this data to investigate various candidate GCM statistical cloud parameterizations and to constrain their empirical parameters. The statistical parameterizations include the following elements: layer total water distributions (PDFs), with and without skewness; diagnostic schemes for layer total water variance; and cloud vertical overlap schemes, such as maximum-random and 'generalized overlap'. For a given analysis region, profiles of GEOS-5 output variables are used to generate an ensemble of subcolumns which are passed through a MODIS L2 simulator algorithm and compared with actual MODIS observations in the analysis region. A multi-parameter minimization technique is then used to find GCM parameters which yield a better fit of simulated and actual MODIS data. Finally, we use CloudSat and CALIPSO data to independently verify the statistical properties of the clouds from GEOS-5 before and after assimilation of MODIS data.
153.	Mr. Edward P Nowottnick *UMD*	The Fate of Saharan Dust Across the Atlantic: An Integrated Modeling and Observational Study of the TC4 Field Campaign	Poster	During the NASA TC-4 field campaign in July 2007, several Saharan dust events were observed over the Caribbean basin. A-Train observations suggest that these Saharan dust events are confined the Caribbean and rarely transported across Central America to the Pacific Ocean. We investigate the nature of this barrier to dust transport using the NASA GEOS-5 atmospheric general circulation model. Our simulations with GEOS-5 are driven by the Modern Era Retrospective-Analysis for Research and Applications (MERRA) meteorological analyses, and include online simulation of aerosol distributions using a version of the Goddard Chemistry, Aerosol, Radiation, and Transport (GOCART) model. Simulated dust distributions are evaluated using A-Train observations from MODIS and CALIOP, as well as MISR and ground-based AERONET sun photometers, and show good agreement with the observations in terms of the timing and magnitude of dust events. A component analysis of the dust transport and removal pathways is used to evaluate the relative roles of these processes in establishing the observed dust transport barrier. From this analysis, we show that while both atmospheric dynamics and wet removal contribute towards the Caribbean dust barrier, northward dust transport is the more dominant term. Additional simulations are performed to ascertain the sensitivity of our results to uncertain loss processes (i.e., wet removal) in our model.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
154.	Prof. Hajime Okamoto *Kyushu University*	Study of cloud particle phase, orientation and microphysics using CloudSat and CALIPSO	Poster	Global analysis of cloud phase and orientation of ice crystal orientation were studied from CALIPSO data using attenuated backscattering and depolarization ratio. Cloud particle type was determined by the combined use of depolarization ratio and the ratio of attenuated backscattering coefficients for vertically consecutive layers. Ice crystals were further categorized into randomly oriented ice crystals (3D-ice) and horizontally oriented plates (2D-plate). We found the 2D-plate occurred between -10 degree C and -20 degree C. We compared the results with obtained using the VFM. The VFM tended to show a homogeneous cloud type through the entire cloud layer in vertical directions and misclassified 2-D plate as water. By the proposed method, water cloud occurrence in subtropical and tropical regions was greater than in the other regions. We developed a new radar-lidar algorithm that can be applied to CloudSat and CALIPSO data to retrieve ice microphysics. The algorithm can analyze specular reflection of lidar signals often observed by CALIPSO due to the existence of 2D-plate. The new algorithm required depolarization ratio measured by CALIPSO in addition to radar reflectivity measured by CloudSat and backscattering coefficient at 532nm by CALIPSO. Global analyses of ice microphysics for CloudSat and CALIPSO overlapping regions were performed. The retrieved parameters were effective radius, ice water content and mixing ratio of 2D-plate. IWC tended to be larger over land. Land-Ocean differences in microphysics were also studies. The IWC tended to have two maxima in the tropics. Effective radius differences were not so large except for high latitude regions.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
155.	Prof. Taikan Oki *JAXA/EORC and IIS/UT*	INTEGRATING A-TRAIN INFORMATION ON WATER BY OFFLINE SIMULATION OF A LAND SURFACE MODEL	Poster	The major sensor of the Water Series of Global Change Observation Mission (GCOM-W1) is The Advanced Microwave Scanning Radiometer-2 (AMSR2). AMSR2 is multi-frequency, total-power microwave radiometer system with dual polarization channels for all frequency bands. The instrument is a successor of AMSR on the Advanced Earth Observing Satellite-II (ADEOS-II) and AMSR for the Earth Observing System (AMSR-E) on NASA's Aqua satellite. Standard products of GCOM-W1 based on AMSR2 data are currently defined. All the eight standard products are: integrated water vapour, integrated cloud liquid water, sea surface temperature, sea surface wind speed, and sea ice concentration over ocean, snow depth and soil moisture content over land, and precipitation over the globe except for high latitude. Development of the GCOM-W1 system is going smoothly. Current target launch year of GCOM-W1 is in Japanese fiscal year 2011. Participation of GCOM-W1 in the A-Train constellation is now being coordinated. This is beneficial both to the inter-sensor calibration between AMSR-E and AMSR2, and synergistic use of the multiple instruments available in the A-Train. Offline simulation system of a land surface model has been developed at JAXA/EORC as for a pilot system of the future data assimilation products merging satellite data and model estimates, and shows promising results. The future possibility of installing a U.S. provided scatterometer on the second generation satellite of GCOM-W (GCOM-W2) is under discussion. Simultaneous active and passive microwave measurements will enhance the water cycle observation capability of the GCOM-W series.
156.	Dr. Ali Omar *NASA*	Using CALIPSO's ocean surface lidar return signal and AMSR-E wind fields to determine aerosol optical depths over the ocean	Poster	The aerosol types found over the ocean exhibit a wide range of radiative characteristics, from highly absorbing (biomass burning smoke) to highly scattering (non-seasalt sulfates, seasalt, some dusts etc). Since marine aerosol transport and generation phenomena are impacted by wind patterns and continental sources, the aerosol types over the ocean tend to be regional. There are therefore significant differences in optical characteristics between the remote oceans and coastal waters. Relationships between wave slope variance and wind speed, based on comparison between CALIPSO lidar sea surface backscatter and collocated Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E) wind speed measurements have been established by Hu et al (2007). Using these relationships, we use collocated sea surface backscatter measurements from CALIPSO and AMSR-E wind speed measurements to determine atmospheric column optical depth over the ocean. We then derive the aerosol column optical depth and use it to constrain the CALIPSO lidar attenuated backscatter measurements to derive spatially and temporally varying lidar ratios over the ocean.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
157.	Dr. Min M Oo *CIMSS (UW-Madison)*	Improving the CALIOP aerosol optical depth retrieval using combined MODIS-CALIOP observations	Poster	Aerosol optical depth retrieval from CALIOP is complicated by requiring knowledge of the aerosol lidar ratio that varies significantly with aerosol types. For most CALIOP retrievals the lidar ratio is ill constrained and estimated by correlating CALIOP observables (depolarization and backscatter) with pre-computed lidar ratio climatologies. Applying a lidar ratio not representative of the observed aerosols will result in significant AOD biases and is one of the primary sources of uncertainty in the current CALIOP AOD. We show evaluation of the MODIS and CALIOP Aerosol Optical Depth (AOD) retrieval and develop a combined MODIS/CALIOP AOD retrieval leveraging the vertical resolved CALIOP and multi-spectral MODIS observations. Over ocean the MODIS sensitivity to the fine and coarse mode aerosol-mixing ratios provides additional constraints to the aerosol lidar ratio. When collocated with CALIOP, the improved lidar ratio significantly reduces the CALIOP AOD uncertainties. In addition, we demonstrate that the CALIOP integrated attenuated color ratio is correlated with the MODIS fine and coarse mixing ratios in marine environments. This finding suggests that for a CALIOP only AOD retrieval the integrated attenuated color ratio can be used to better constrain the lidar ratio, as well as improve the accuracy of the retrieved

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
158.	Dr. Lazaros Oreopoulos *NASA-GSFC*	Investigating the relationship between cloud fraction overlap parameters and rank correlations of cloud condensate/extinction from CloudSat data	Poster	The details of cloud overlap have been shown to have large influence on the transfer of solar and thermal radiation. The overlap has usually been framed in terms of vertical cloud fraction overlap, i.e., the probability that given the presence of cloud at particular horizontal location in some atmospheric layer, cloud will also be present at the same horizontal location at an arbitrary vertical separation. It is currently common to convey this probability with a parameter representing the relative weight of maximum and random overlap cloud fractions needed to match the actual cloud fraction of the pair of layers. The concept of cloud overlap however, can be also extended to the rank correlation of cloud condensate or optical extinction between layers. This governs the likelihood that a large water content or optical depth in one vertical layer (relative to that layer's water content range) will be paired with a relatively large water content or optical depth in another layer, and vice-versa. In like manner to the cloud fraction overlap parameter, it has been suggested that this rank correlation can also be approximated by an exponential decrease with layer separation, albeit at faster rates than cloud fraction correlation. Our analysis of ground-based cloud radar data has indicated that these overlap parameters are related. Specifically, for a midlatitude location, we have found more occurrences of large rank correlation for the large cloud fraction overlap parameter bins. This indicates that the more the cloud fraction overlap tends toward maximum overlap, the higher the likelihood that the condensate rank correlation will also be high. The relationship manifests itself also when expressed in terms of true combined cloud fraction and rank correlations: on average, the higher the combined cloud fraction, the lower the rank correlation, and the higher the frequency of negative rank correlations. The relationships between the two overlap parameters can of course be more thoroughly investigated with CloudSat data which provide the advantage of global coverage. In our presentation we will use the cloud mask data of the 2B-GEOPROF dataset (or 2B-GEOPROF-LIDAR, if available) and coincident condensate/optical depth data of the 2B-CWC and 2B-TAU products (screened for precipitation using 2C-PRECIP-COLUMN) to calculate the values of the parameters and to examine their relationships for different geographical zones and seasons. We will discuss the implications of these findings for developing rules in GCM cloud parameterizations that determine rank correlations when cloud fraction overlap parameters have been diagnosed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
159.	David Painemal *University of Miami*	Validation of the MODIS cloud effective radius and optical thickness over the Southeast Pacific during VOCALS-REx	Poster	The ability of the Moderate Resolution Imaging Spectroradiometer (MODIS) retrievals to represent the microphysical properties of the Chile-Peru stratocumulus deck is investigated. MODIS estimates (10:30 LT and 15:30 LT) were compared against NCAR C-130 aircraft-derived values collected during the Variability of the American Monsoon Systems' (VAMOS) Ocean-Cloud-Atmosphere-Land Study Regional Experiment (VOCALS-REx), in October-November 2008. The in situ drop size distributions were constructed from the Cloud Droplet probe (drop diameter < 52 micron) and the two-dimensional cloud probe (drop diameters up to 1600 micron). The MODIS cloud optical thickness (τ) closely matched the in-situ value with a positive bias (1.3), though individual values underestimate the actual τ. In contrast, the standard 2.1 micron-derived MODIS cloud effective radius (re) was found to systematically exceed the in-situ cloud-top effective radius, with a mean bias of 2 um, increasing with droplet size. Although the mean bias is reduced when using the 3.7 micron-derived re in the comparison, the MODIS re is always larger that the in-situ value. The offset is not explained by the stratified cloud vertical structure nor by drizzle occurrence. Although the three-dimensional radiative transfer effects cannot be discarded, our results do not show some typical patterns associated with these effects, that is, an overestimate in re and an underestimate in τ. Additionally, the good viewing sensor and solar angles should help to ameliorate the three-dimensional radiative transfer effects. The MODIS re estimates had ramifications for secondarily-derived MODIS liquid water paths that were then found to exceed the in situ liquid water path values. MODIS re and τ were also combined to form a cloud droplet number concentration (Nd) estimate assuming an adiabatic vertical structure. We found that, when selecting appropriate parameters, MODIS Nd agreed the best of the four MODIS variables with the aircraft observations, with an almost negligible offset and a high linear correlation (r = 0.94). In addition, a decrease in MODIS Nd between the morning and afternoon overpasses noted for selected cases was confirmed by the in-situ Nd values, and does not appear to be a retrieval artifact.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
160.	Dr. Laura Pan *National Center for Atmospheric Research*	The Relationship of Cloud Top to the Tropopause/Jet Structure from CALIPSO Data	Poster	Cloud top and tropopause relationships are examined using CALIPSO cloud data and high resolution NCEP Global Forecast System (GFS) tropopause data. Our goal is to characterize the constraint of the background thermal and dynamical structure on cloud occurrences. Statistical analyses of cloud top occurrence in tropopause/jet referenced relative altitude coordinates are performed on a global scale using 1-year (2007) of CALIPSO 5 km resolution cloud layer data. The results show that the thermal tropopause appears to be a significant constraint for the cloud top. Using the correlation between the change of the tropopause height and the jet location, the tropics and the extratropics are effectively separated. The analyses show that there is no statistically significant cloud top occurrence above the tropopause in the extratropics, and there is no statistically significant cloud top occurrence higher than one kilometer above the tropopause in the tropics. Our analyses also show that the tropopause determination is a significant component of this type of studies and that errors in the tropopause height may lead to significantly different conclusions. To investigate this issue, we examined the tropopause products from the GFS analyses and the GEOS5 model (given as auxiliary data in the CALIPSO cloud layer data) in comparison with high-resolution radiosonde data from the TC4 campaign. The results show that the GEOS5 tropopause product has significant uncertainty and will have an impact on the cloud top analyses. We further investigated the differences between the thermal and the cold point tropopause in the tropics using the radiosonde data and compared with the collocated CALIPSO data. Based on selected case analyses, we suggest that the differences of the thermal and the cold point tropopause may be largely responsible for the cloud tops that do occur above the thermal tropopause in the tropics.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
161.	Mathieu PAPAZZONI *Laboratoire Atmosphères, Milieux, Observation Spatiales*	Frequency of occurrence, macrophysical and microphysical properties of ice clouds in the West-African monsoon region.	Poster	Clouds remain one of the main sources of uncertainty in global climate models. As a consequence of that, the accuracy of the predictions is reduced. To improve the representation of clouds in models and our knowledge of the cloud properties, it is crucial to establish climatologies using measurements from remote sensing instruments. It is for this reason that the distributions of occurrence frequencies, macrophysical properties (number of layers, altitude and thickness) and microphysical properties (ice water content, extinction coefficient and effective radius) of the ice clouds in the West-African monsoon have been studied with the three first years of CloudSat/CALIPSO data. The originality of this approach lies in the use of CloudSat/CALIPSO data for studying the West-African monsoon. A first conclusion is the fact that the CloudSat data are very well adapted to carry out a study on a domain like this one (from 30°W to 40°E, from 10°S to 25°N). The frequency of occurrence distributions have been studied at different time (annual and monthly) and space (maps and zonal averages) scales with the 2B-GEOPROF-LIDAR product. To differentiate the precipitating and non-precipitating ice clouds, we used the 2B-GEOPROF product. The interannual variability was also studied, to estimate the relevance of the obtained climatologies. This study shows interesting features: for the whole season, the non-precipitating systems are characterized by high occurrence frequencies between 2°N and 15°N. These frequencies drop outside of this domain. The interannual variability is small, except over the Gulf of Guinea. The precipitating ice clouds are mainly located over the continent near the coast. Their spatial variability is important but corresponds to small values of occurrence frequencies. The monthly study shows an important evolution of the distributions and the values of the occurrence frequencies during the phenomenon of monsoon, which follows its different steps (pre-onset, onset, peak and retreat periods). The study of the macrophysical properties has allowed characterizing the mean height, the mean thickness and the frequency of multilayer situations of ice clouds on an annual time scale. Climatologies of microphysical properties of non-precipitating ice clouds are established over the whole domain on an annual scale using the 2B-CWC-RO product. They show well-defined distributions, which vary significantly with height. Several modes have been highlighted, due to different types of clouds and different microphysical processes. Comparisons with ground-based radar data have been made and show similarities. Their temporal and spatial variability have been studied. The main characteristics are almost invariant during the monsoon season. The spatial variability is more important and can be explained by the variability of different parameters such as relative humidity, aerosol concentration, convection intensity and location. Finally a comparison between continental and oceanic systems is made and shows some differences which also can be explained by the variations of atmospherical parameters.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
162.	Prof. Frédéric PAROL *Laboratoire d'Optique Atmosphérique/Univ. Lille1/CNRS*	Statistical comparison of cloud fractions derived from POLDER/PARASOL and MODIS/AQUA	Poster	PARASOL and AQUA are two satellites on sun-synchronous orbits in the A-Train constellation. Aboard these two platforms, POLDER and MODIS provide quasi-simultaneous and coincident observations of cloud properties. The similar orbits but different detecting characteristics of these two sensors call for a comparison between the derived datasets in order to identify and quantify potential uncertainties in retrieved cloud properties. To focus on the differences due to different sensor spatial resolution and coverage, while minimizing sampling and weighting issues, we have recomputed monthly statistics directly from the respective official level 2 products. We have developed a joint dataset that contains both POLDER and MODIS level 2 cloud products collocated on a common sinusoidal grid. We have then computed and analyzed monthly statistics of cloud fraction. This simple yet crucial cloud parameter needs to be clearly understood to allow further comparison work of the other cloud parameters. From our study, we demonstrate that on average POLDER and MODIS datasets capture correctly the main characteristics of global cloud cover and provide similar spatial distributions and temporal variations. However each sensor has its own advantages and weaknesses to discriminate between clear and cloudy skies in particular situations. We found a global negative difference of about 10% between POLDER and MODIS Day-Mean cloud fraction. On the contrary, a global positive difference of about 10% exists between POLDER and MODIS Combined-Mean cloud fraction. These statistical biases show both global and regional distributions that can be driven by sensors characteristics, environmental factors (bright surfaces, heavy aerosol loadings) and also carry potential information on cloud cover structure. These results provide information on the quality of cloud cover derived from POLDER and MODIS and should be taken into account for the use of other cloud products derived from these sensors.
163.	Philip Partain *CIRA, Colorado State University*	Overview of CloudSat Data Processing, New Products, and Reprocessing Plan	Poster	All of the Level 0, 1, and 2 data products for the CloudSat Mission are produced by the CloudSat Data Processing Center (DPC) at Colorado State University. Data are downlinked from the spacecraft, via the USAF Satellite Communications Network, to the mission command and control center at Kirtland AFB, NM. There the data are decommutated, placed into blocked binary data files, and served to the CloudSat Data Processing Center to be processed to level 0-2 products. These products are then archived, and distributed by the DPC via a web-based data ordering system. This poseter provides details of the CloudSat Cloud Profiling Radar, “Standard” and “Enhanced” data products, and the data processing, archive, and distribution system. An updated schedule will be presented for the release of Version 05 enhanced products (including precipitation and combined CloudSat/CALIPSO products).

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
164.	Dr. Falguni Patadia *GEST/UMBC*	Empirical Angular Dependence Models For Smoke Aerosols From CERES onboard Terra and Aqua	Poster	Aerosols from biomass burning activity cause direct and indirect radiative impacts on the climate both at regional and global scales. However, their impacts are relatively uncertain [IPCC 2007]. To reduce the associated uncertainty, it is important to study the aerosol radiative forcing (ARF) using observations from space and ground based instruments. Satellite observation based methods depend on TOA radiative flux measurements in the absence and presence of aerosols. These radiative fluxes are calculated using angular dependence models (ADM) to account for radiative anisotropy. One of the uncertainties in estimating ARF is from the ADM used to convert the satellite radiance to flux. The current state-of-art fluxes ADMs from CERES-Terra and CERES-Aqua instrument does not account for aerosols over land. Therefore, to address the impact of smoke aerosols on the shortwave radiance anisotropy and the shortwave ARF, we constructed empirical ADM from CERES Terra and Aqua observations. The smoke ADM are constructed for clear sky conditions and for the biomass burning region in South America (0-20S, 40-70 W). We used the dry season data (August-October) from 9 years of CERES observations (2000-2008) for this study. In this paper, we present the smoke ADM that are characterized by surface albedo, aerosol optical thickness (from MODIS), solar, viewing and relative azimuth angles. We compare our results with existing operational TOA shortwave fluxes from CERES onboard Terra and Aqua. We discuss the uncertainty in ARF estimates due to uncertainty in ADM.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
165.	Dr. Jacques Pelon *UPMC-CNRS*	Characterization of Eyjafjallajökull atmospheric plumes by CALIPSO over the Atlantic Ocean after the May eruption	Poster	Volcanic activity can have a significant climatic impact depending on aerosol amount, residence time, and altitude of injection as experienced after Pinatubo eruption in 1982. Important injections in the troposphere, can induce significant environmental and meteorological perturbations. Volcanic eruptions may cause damage to aircraft engines, and survey of such events has become a major issue, both in terms of risk for passengers and economical concern. Unlike the Laki eruption, more than two centuries ago, the eruption of Eyjafjallajökull located in the same volcanic chain in Iceland, lead to much smaller amounts of gas and ash to be transported to Europe in the troposphere, although it lead to significant sulfur dioxide and silicated material injection. Difficulties in addressing the consequences lead to close down the air traffic over Europe, causing severe problems. It has thus become of major importance to precisely characterize transported material characteristics from observations and provide such information as inputs and control to transport models. It is one of the advantages of the CALIPSO mission to combine Lidar and IR instruments to provide co-located observations directly exploitable for the detection and characterization of aerosol and clouds. CALIPSO, as part of the A-Train further benefits of an unprecedented observational environment, which enables combined analyses with CloudSat and AQUA. Furthermore, the overpasses of the A-Train provide a snapshot into observations from geostationary platforms, such as (MSG) over Europe, which can be of valuable interest to follow the dispersion and modifications of plumes on a regular basis. IR observations have been long used to characterize volcanic emitted material. In this presentation, we will focus on observations made after the third eruption of the Iceland volcano in 2010. Emitted plumes were transported over the Atlantic ocean, west of Europe, frequently covered with low clouds, so that potential observations from the surface cannot be done, and radiometric observations in the visible are largely perturbed. We show that the complementary observations of CALIPSO and A-Train sensors allow to identify, to characterize and quantity transported volcanic ash amount, and to follow its evolution. More particularly, we take advantage of the IR observations to characterize large size particles composed of silicate material, and use the potential of combined IR and lidar observations, involving newly developed research products to analyze aerosol optical depths over clouds and ocean, and identify particle type (including water or ice) after the eruption took place.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
166.	Dr. Maksym Petrenko *ESSIC UMCP / NASA Goddard*	Integrated analysis of aerosol products from multiple A-Train sensors collocated with AERONET observations	Poster	The A-Train satellite formation carries an array of instruments for measuring a wide range of atmospheric aerosol properties that provide a vital base for the climate research. A shared orbit and close overpass times allow for synergy between the aerosol products from the different sensors. Still, data synergy and integrated analysis of the complimentary measurements from the multiple instruments are largely limited by the differences that exist in the aerosol products, including dissimilar spatial and temporal resolutions, archival strategies, approaches to quality control, and so forth. The problem is further complicated by the differences in the algorithms, underlying assumptions, and uncertainties involved in creating the products. To address these issues, we developed a Multi-sensor Aerosol Products Sampling System (MAPSS) that provides a single and unified framework for studying the diverse aerosol products. MAPSS co-locates measurements from multiple A-Train satellite sensors (Aqua-MODIS, Aura-OMI, Parasol-POLDER, and Calipso-CALIOP), as well as Terra satellite sensors (Terra-MODIS, Terra-MISR), over a large number of important locations worldwide, including the Aerosol Robotic Network (AERONET) sites, to facilitate integrated validation and comparative analysis of the satellite aerosol measurements using the AERONET and other compatible ground-based and in situ data. During our presentation, we will explain the foundation of the MAPSS framework. We will also show specific examples of using MAPSS to analyze and compare related aerosol measurements produced by the A-Train sensors.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
167.	Mariya Petrenko *Purdue University*	Using spaceborne aerosol observations to constrain biomass burning emissions in the GOCART model	Poster	Simulations of biomass burning (BB) emissions in global aerosol models strongly depend on the inventories that define emission source location and strength. Several global products are currently available that contain BB emission estimates with different spatial and temporal resolution, and can be used with global chemistry transport models. However, estimates of BB aerosol emissions provided by these inventories can differ by a factor of 2 or more regionally. Such variability of emission amounts inevitably leads to discrepancies in the simulated aerosol effects. We use total column aerosol optical depth (AOD) observed by the MODIS and MISR instruments on the Terra satellite, and MODIS on Aqua, to provide top-down constraints on the strength of biomass burning emission sources. We also use measurements of plume heights from MISR and aerosol layer heights from CALIOP on CALIPSO satellite, to constrain emission injection heights and simulated plume evolution and transport. We chose several burning events during 2006 in different regions of the Earth to develop and test the feasibility of our approach, and use the GOCART model (global aerosol chemistry, radiation and transport model) to simulate BB aerosols, their emission, evolution, transport and removal. We used several global biomass burning products (combinations of different burned area, fuel loads and emission factors) to drive the model. The diversity in simulated aerosol optical depth as a result of using different emission inputs is presented for select case studies, along with the space-borne maps of total-column AOD used as reference, and as instantaneous constraints on integrated source strength.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
168.	Ms. Sophie Peyridieu *Laboratoire de Météorologie Dynamique, CNRS/IPSL, France*	Dust aerosol climatology retrieved from AIRS and IASI infrared sounders : optical depth, mean altitude and effective radius compared to other A-Train aerosol datasets (MODIS, CALIOP, PARASOL).	Poster	Remote sensing in the thermal infrared is needed for the evaluation of aerosol total radiative forcing. Besides the capability to measure night and day and over both ocean and land, a key point of infrared remote sensing is its ability to retrieve aerosol optical depth as well as mean dust layer altitude, a variable required for measuring their impact on climate. The colocation with other aerosol sensors on the A-Train opens the way to the full description of dust aerosols properties: optical depth, mean altitude, effective radius. Our algorithm is specifically designed to retrieve simultaneously coarse mode dust aerosol 10 µm optical depth (AOD) and mean layer altitude from high spectral resolution infrared sounders observations. Thanks to IASI higher spectral resolution, the selection of finer channels for aerosol detection allows an even more accurate determination of aerosol properties. In this context, results obtained from 7 years (2003-2010) of AIRS/Aqua and more than 2 years (2007-2010) of IASI/Metop observations over the tropical oceans have been compared to other aerosol spaceborne sensors. Compared to MODIS/Aqua optical depth product, 10 µm dust optical depth shows a very good agreement, particularly for tropical Atlantic regions downwind of the Sahara during the dust season. Comparisons with PARASOL non-spherical coarse mode product allows explaining small differences observed far from the sources. Time series of the mean aerosol layer altitude are compared to the CALIOP Level-2 products starting June 2006. For regions located downwind of the Sahara, the comparison again shows a good agreement with a mean standard deviation between the two products of about 400 m over the period processed, demonstrating that our algorithm effectively allows retrieving accurate mean dust layer altitude. Preliminary results of the mean effective radius of the dust coarse mode retrieved from IASI will be presented. A 7-year global climatology of the aerosol 10 µm dust optical depth and of the layer mean altitude has also been established, emphasizing the natural cycles of Saharan dust. Application of this method over continental surfaces, such as the Sahara desert, is currently being made possible by the retrieval of surface temperature and emissivity from IASI observations. This a priori knowledge opens the way to retrieving dust sources over land in the infrared.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
169.	Michael Pitts *NASA Langley Research Center*	A CALIPSO Perspective of the Unusually Cold 2009-2010 Arctic Winter	Poster	An intensive field campaign focused on measurements related to PSCs and ozone chemistry was conducted in the Arctic during January-March 2010 as part of the European Union RECONCILE project. To complement the more focused measurements from the RECONCILE field campaign, we have used spaceborne lidar measurements from CALIPSO to characterize PSC occurrence and composition during the 2009-2010 season on vortex-wide scales. The 2009-2010 Arctic winter was unusually cold at stratospheric levels from mid-December through the end of January and one of only a few winters over the past half-century with synoptic-scale temperatures below the frost point. It was also the most intense PSC season of the CALIPSO four-year data record with more PSCs observed than in the three previous Arctic seasons combined. In addition to there being many more PSC observations during the 2009-2010 season, the distribution of PSCs among the various composition classes was also different from previous years with significantly more observations of ice clouds and higher number density NAT (nitric acid trihydrate) mixtures. Through our examination of the 2009-2010 season, we found that it can roughly be divided into four time periods with distinctly different PSC optical characteristics. In this paper, we present a general overview of the 2009-2010 winter, examine in detail the evolution of PSC composition during the season, and explore the unique aspects of this season in attempt to understand the underlying physical mechanisms.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
170.	Dr. Derek Posselt *University of Michigan*	A-Train-Based Examination of the Relationship Between Aerosols, Cloud Vertical Structure, and Cloud Radiative Forcing in Midlatitude Cyclones	Poster	The warm conveyor belt airstream is the dynamical driver for cloud and precipitation production in the warm frontal portions of extratropical cyclones. Though the warm conveyor belt circulation has been extensively studied from theroretical and observational perspectives, details of the vertical structure of clouds and precipitation in warm frontal zones are still largely unknown. Outstanding questions center on the influence of aerosols on clouds, precipitation and radiative fluxes, the interaction between clouds vertical structure and radiation, the rate of conversion of water vapor to precipitation (precipitation efficiency), and the interaction of latent heat release with frontal structure. Although the synoptic scale circulation provides the mechanisms for forced ascent and moisture transport, it is the cloud scale frontal circulations, vertical distribution of aerosol and cloud condensate, and details of the cloud microphysical interactions that lie at the center of the research questions outlined above. This presentation provides an overview of the work we have done to date examining frontal processes from an A-Train perspective. We demonstrate the utility of CloudSat and CALIPSO for examining characteristic cloud fraction in warm frontal composites and for detailing the vertical structure of cloud and precipitation condensate in specific cases. We also briefly explore the effect of changes in aerosol concentration on the cloud distribution and properties in extratropical cyclones. This work has laid the foundation for a comprehensive observation and modeling study aimed at using A-Train and fine-scale numerical models to examine the vertical and horizontal structure of cloud liquid and ice in warm frontal zones for several northern and southern hemisphere seasons. A significant part of this study is a model and observation based exploration of the influence of aerosol on frontal clouds, precipitation, and radiative fluxes.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
171.	Kory J Priestley *NASA LaRC*	Achieving Radiometric Accuracy and Stability from the Clouds and the Earth's Radiant Energy System (CERES) Sensors in the A_Train Orbit	Poster	The goal of the Clouds and the Earth's Radiant Energy System (CERES) project is to provide a long-term record of radiation budget at the top-of-atmosphere (TOA), within the atmosphere, and at the surface with consistent cloud and aerosol properties at climate accuracy. To date, five CERES instruments (PFM, FM1-FM4) have flown on three different spacecraft: TRMM, EOS-Terra and EOS-Aqua. Each CERES instrument is a scanning broadband radiometer that measures filtered radiances in the reflected solar region (wavelengths between 0.3-5 μm), total (TOT) (wavelengths between 0.3-200 μm) and emitted thermal region (wavelengths between 8-12 μm) regions. A Rigorous pre-launch radiometric ground calibration is performed on each CERES sensor to ensure accuracy requirements of 1% and 0.5% (1-sigma) for SW and LW radiance observations respectively are met. Any ground to flight or in-flight changes in radiometric response are monitored using a protocol employing both onboard and vicarious calibration sources and experiments. Studies of FM-1 through FM-4 flight observations have shown that the SW response of space based broadband radiometers can change dramatically due to optical contamination in the operational environment. The changes are greatest for wavelengths below 700 nm, and are particularly difficult to monitor using in-flight tungsten calibration lamps that are devoid of output in this spectral region. This poster summarizes the CERES pre-flight and in-flight radiometric calibration and validation protocols that have ensured the science requirements have been, and continue to be met, in the A-Train orbit.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
172.	Kory J Priestley *NASA LaRC*	CERES on NPP : Continuation of the Earth Radiation Budget Climate Data Record	Poster	The goal of the Clouds and the Earth's Radiant Energy System (CERES) project is to provide a long-term record of radiation budget at the top-of-atmosphere (TOA), within the atmosphere, and at the surface with consistent cloud and aerosol properties at climate accuracy (Wielicki et al., 1996). CERES consists of an integrated instrument-algorithm-validation science team that provides development of higher-level products (Levels 1-3) and investigations. It involves a high level of data fusion, merging inputs from 25 unique input data sources to produce 18 CERES data products. Over 90% of the CERES data product volume involves two or more instruments. Continuation of the Earth Radiation Budget (ERB) Climate Data Record (CDR) has been identified as critical in the 2007 NRC Decadal Survey, the Global Climate Observing System WCRP report, and in an assessment titled 'Impacts of NPOESS Nunn-McCurdy Certification on Joint NASA-NOAA Climate Goals'. To date, five CERES instruments (PFM, FM1-FM4) have flown on three different spacecraft: TRMM, EOS-Terra and EOS-Aqua. In response, NASA, NOAA and NPOESS have agreed to fly the final existing CERES Flight Model (FM-5) on the NPP spacecraft for launch in 2011 and to procure an additional CERES Sensor with modest performance upgrades for flight on the NPOESS C1 spacecraft in 2014, followed by a new CERES follow-on sensor for flight in 2018 on the NPOESS C3 spacecraft. While science goals remain unchanged for the long-term ERB Climate Data Record, it is now understood that the task of achieving these goals is more difficult for two reasons. The first is an increased understanding of the dynamics of the Earth/atmosphere system which demonstrates that rigorous separation of natural variability from anthropogenic change on decadal time scales requires observations with higher accuracy and stability than originally envisioned. (Ohring, et. al, 2005, 2007) Secondly, future implementation scenarios involve less redundancy in flight hardware (1 vs. 2 orbits and operational sensors) resulting in higher risk of loss of continuity and reduced number of independent observations to characterize performance of individual sensors. Although the EOS CERES observations realize a factor of 2 to 4 improvement in accuracy and stability over previous ERBE Climate Data Records, future sensors will require an additional factor of 2 improvement to answer rigorously the science questions moving forward. Modest investments, defined through the CERES Science Team's 30-year operational history of the EOS CERES sensors, in onboard calibration hardware and pre-flight calibration and test program will ensure meeting these goals while reducing costs in re-processing scientific datasets. The CERES FM-5, and future, pre-flight radiometric characterization programs will benefit from the operational experience of the CERES EOS sensors, including stronger emphasis of radiometric characterization in the Statement of Work with the sensor provider. Improvements to the pre-flight program include increased spectral, spatial, and temporal sampling under vacuum conditions as well as additional tests

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
173.	Dr. Alain Protat *CAWCR*	Evaluation of ACCESS-A Clouds and Convection using Near Real-Time CloudSat-CALIPSO Observations	Poster	The importance of clouds on climate through their direct effect on the Earth radiation budget and water cycle is well recognized. Clouds and their interaction with incoming and outgoing radiation remain the largest source of uncertainty among future climate projections produced by climate models. The way clouds are represented in numerical weather prediction (NWP) models also significantly affects the quality of weather forecasts. The representation of deep convective systems and associated rainfall is also still a major challenge for NWP models, as there is growing evidence that NWP models produce way too many events but characterized by too little rainfall. The A-Train offers new and unique opportunities to evaluate NWP models at global and regional scales, and for different weather regimes. As part of the A-Train, CloudSat and CALIPSO provide a vertically-resolved description of the geometrical and microphysical properties of clouds and convection, which is crucial for model evaluation. In the present paper we describe a platform for the evaluation of clouds and convection generated by the regional and limited-area versions of the operational Australian NWP model (ACCESS) using near real-time observations of the CloudSat and CALIPSO mission from which radar-lidar cloud and convection masks are directly produced. The potential of this platform for model verification and for the evaluation of products assimilated by models will be highlighted using the case study of Tropical Cyclone Olga (28/01/2010 in Northern Australia), and different skill scores calculated using three months of ACCESS forecasts will also be shown and discussed. Comparisons between two cloud microphysical schemes will also be interpreted.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
174.	Dr. Anita Rapp *Texas A&M University*	Precipitation in Southeastern Pacific Marine Stratocumulus from CloudSat	Poster	The marine stratocumulus (mSc) region in the southeastern Pacific Ocean is one of the most radiatively important areas in the world and is a source of major uncertainty in existing climate models. The feedbacks between precipitation and the properties of these clouds are still poorly understood and a better understanding of the role of the precipitation is crucial. Existing climatologies of precipitation in this region indicate very little precipitation, however recent studies have shown that drizzle may be more prevalent than previously thought. The CloudSat estimates of precipitation are providing much needed information on drizzling mSc clouds. Precipitation occurrence and rain rate estimates from the CloudSat attenuation-based 2C-PRECIP-COLUMN retrieval are examined in the southeast Pacific mSc region and compared to existing estimates. Preliminary results indicate that drizzle (<0.2 mm/hr) occurs more frequently near the coast of South America and light rain (>0.2 mm/hr) increases in frequency away from the coast. This supports findings from the Eastern Pacific Investigation of Climate (EPIC) and the Variability of the American Monsoon Systems (VAMOS) Ocean-Cloud-Atmosphere-Land Study (VOCALS) campaign in situ measurements that also showed this westward increase in precipitation due to both anthropogenic effects near the coast and increasing depth of the boundary layer further to the west. While the overall pattern of precipitation agrees with in situ measurements, significant differences are observed between the attenuation-based 2C-PRECIP-COLUMN estimates and EPIC radar reflectivity-rainfall (Z-R) relationships applied to the CloudSat reflectivity data. The attenuation-based estimates are on average higher, especially in the drizzle regions near the coast. CloudSat-retrieved precipitation and cloud properties are also compared for open- and closed-cell cumulus in this region. Isolated open drizzle cells exhibit higher reflectivity and instantaneous rain rates than closed drizzle cells, although the areal extent of precipitation is larger for the latter. Aircraft in situ measurements from VOCALS are also compared to CloudSat measurements for a region of transition from closed- to open-cell cumulus to further investigate the differences in precipitation in these clouds.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
175.	Dr. Jens Redemann *BAERI / NASA Ames Research Center*	The combined use of CALIPSO, MODIS and OMI level 2 aerosol products for calculating direct aerosol radiative effects	Talk	We describe a technique for combining CALIPSO aerosol backscatter, MODIS spectral AOD (aerosol optical depth), and OMI AAOD (absorption aerosol optical depth) measurements for the purpose of calculating direct aerosol radiative effects. In the first step of our strategy for combining these data sets we seek to find all the combinations of MODIS microphysical aerosol particle models that are reconcilable with the OMI and CALIOP observations within the uncertainties of their respective retrievals. In a second step, we use these models to forward calculate the aerosol radiative properties required for a full assessment of the direct aerosol radiative forcing, i.e., spectral extinction/AOD, single scattering albedo and asymmetry parameter. In the final step, we use a radiative transfer model to determine how the range of microphysical retrievals translates into a range of radiative forcing estimates. We show sensitivity studies and first results from actual collocated CALIPSO V3, MODIS and OMI data collected in 2007. As a prerequisite for the application of our methodology to the actual satellite observations, we assessed the consistency between comparable measurement quantities from the different A-Train sensors. In particular, for four months in 2007, comparisons of the standard MODIS-Aqua (Collection 5) mid-visible AOD data to the AOD calculated from the latest release (Version 3) of the CALIOP level-2 aerosol extinction profile data set show reasonable agreement between the two data sets. A restriction to scenes with cloud fractions below 1% (as defined in the MODIS aerosol retrievals) generally results in good correlation (r^2>0.5) and rms differences in AOD of 0.12 or less. As a test of our methodology, we applied our multi-sensor retrievals of aerosol radiative properties to airborne HSRL (High Spectral Resolution Lidar) aerosol backscatter data, sunphotometer derived AOD, and in situ aerosol absorption measurements in a fire plume study during the ARCTAS (Arctic Research of the Composition of the Troposphere from Aircraft and Satellites) field campaign in 2008. Radiative fluxes modeled based on the multi-sensor aerosol retrievals compare reasonably well with radiative fluxes measured by an airborne spectral flux radiometer aboard the same aircraft. We found good agreement for the broader wavelength range of 350-2150 nm, but less good agreement for the shorter wavelength range (350-700 nm). We will explore reasons for the differences in agreement, in particular those that can be traced to the newly developed retrieval methodology for aerosol radiative properties.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
176.	Kathryn J Regner *UA-Huntsville AMSR-E SIPS*	Instant Karma: Collecting Provenance for AMSR-E	Poster	Current procedures for capturing and disseminating provenance, or data product lineage, are limited in both what is captured and how it is disseminated to the science community. The Instant Karma project brings together a team of NASA and university researchers with expertise in NASA Earth science data systems, science algorithm development, and provenance collection/dissemination to apply a proven provenance tool to the generation of NASA's AMSR-E standard products, with an initial focus on sea ice products. The project will integrate Karma, a provenance collection and representation tool developed at Indiana University, into the AMSR-E Science Investigator-led Processing System (SIPS) production environment. The AMSR-E SIPS generates Level 2 and Level 3 data products from AMSR-E observations. An initial focus on Sea Ice processing will allow the project to engage the Sea Ice science team and user community in customizing Karma for NASA science data. This poster will introduce both the Karma tools and the AMSR-E SIPS production environment, with a focus on how users will interact with the system. User scenarios involving provenance information will be presented, along with a preview of the AMSR-E Provenance Browser.
177.	Donald L Reinke *CIRA/CSU - CloudSat Data Processing Center*	Multi-Level Probability of Cloud-Free-Line-of-Sight (PCFLOS) from Coincident CloudSat and CALIPSO Observations	Poster	Numerous global Cloud-Free Line of Sight climatologies have been derived from satellite observations of cloud. All have inherent limitations due to the fact that they rely on data from passive meteorological sensors which provide a reasonable measurement of the cloud tops, but provide no information about cloud bases or multi-layered clouds below the highest opaque cloud layer. NASA's exciting new CloudSat and CALIPSO mission data provide, for the first time from space, a direct measurement of the vertical profile of cloud – including cloud bases and the elusive "hidden layers". Four years of CloudSat and CALIPSO data are used to generate Cloud Free Line-of-Sight statistics at 20 vertical levels and 10-degree view angle increments from the satellite perspective. This same technique could be used to generate PCFLOS from a point on the ground along the satellite ground-track. PCFLOS from these new, active, measurement systems can be used to validate and/or improve existing PCFLOS products from passive space or ground-based observations.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
178.	Lorraine A Remer *NASA/Goddard Space Flight Center*	Validating aerosol retrievals and characterizing direct aerosol radiative forcing in the Glory-APS era	Poster	The anticipated launch of Glory with the Aerosol Polarimetric Sensor (APS) opens up unprecedented new opportunities to characterize aerosol, but also introduces new challenges. The current A-Train and Terra aerosol sensors have developed a comfortable partnership with AERONET and occasional field deployments to assess the accuracy of their products and test the applicability of algorithm assumptions. Because of the 6 km swath of APS, and even more importantly because of APS's high accuracy and number of retrieved parameters, we will need a new strategy and new tools. Of primary interest will be the direct measure of the aerosol polarized phase function within a Glory-APS footprint. The UMBC Polar Imaging Nephelometer (PI-Neph) has been desgined for this purpose. The strategy will be to measure the polarized and unpolarized phase function directly with the PI-Neph, retrieve the same from a carefully positioned Cimel radiometer using AERONET inversion techniques, and compare both with the APS space-based measurement. Thus, we are comparing a fundamental observation of the aerosol scattering properties before retrieval of size distribution and refractive indices. Current A-Train sensors, especially CALIOP on CALIPSO will complement the data set with additional observations of the same 6 km pixel. These multiple measures of the same fundamental properties will allow investigations leading to better understanding of the relationship between in situ measures and total column ambient retrievals, the effect of humidification on the aerosol properties and the consequences of subpixels clouds within the 6 km footprint. From these multiple measurements we can benchmark radiative forcing at top, bottom and within the atmosphere so that we can evaluate APS stand-alone estimates of radiative forcing in locations away from supporting instrumentation.

A-Train 2010 Abstract Submissions

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	Name	Abstract Title	Accepted Abstract Format	Abstract
179.	Lorraine A Remer *NASA/Goddard Space Flight Center*	Validating aerosol retrievals and characterizing direct aerosol radiative forcing in the Glory-APS era	Poster	The anticipated launch of Glory with the Aerosol Polarimetric Sensor (APS) opens up unprecedented new opportunities to characterize aerosol, but also introduces new challenges. The current A-Train and Terra aerosol sensors have developed a comfortable partnership with AERONET and occasional field deployments to assess the accuracy of their products and test the applicability of algorithm assumptions. Because of the 6 km swath of APS, and even more importantly because of APS's high accuracy and number of retrieved parameters, we will need a new strategy and new tools. Of primary interest will be the direct measure of the aerosol polarized phase function within a Glory-APS footprint. The UMBC Polar Imaging Nephelometer (PI-Neph) has been desgined for this purpose. The strategy will be to measure the polarized and unpolarized phase function directly with the PI-Neph, retrieve the same from a carefully positioned Cimel radiometer using AERONET inversion techniques, and compare both with the APS space-based measurement. Thus, we are comparing a fundamental observation of the aerosol scattering properties before retrieval of size distribution and refractive indices. Current A-Train sensors, especially CALIOP on CALIPSO will complement the data set with additional observations of the same 6 km pixel. These multiple measures of the same fundamental properties will allow investigations leading to better understanding of the relationship between in situ measures and total column ambient retrievals, the effect of humidification on the aerosol properties and the consequences of subpixels clouds within the 6 km footprint. From these multiple measurements we can benchmark radiative forcing at top, bottom and within the atmosphere so that we can evaluate APS stand-alone estimates of radiative forcing in locations away from supporting instrumentation.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
180.	Dr. Mathieu Reverdy *Ecole Polytechnique - LMD*	Processes leading to the formation of subvisible cirrus in the tropical UTLS using CALIOP	Poster	Since some years, data provided by cloud-satellites (especially A-Train) but also by in situ measurements revealed a large quantity of ultra-thin ice clouds located within or just below the tropical tropopause layer (TTL). Those clouds are classified as subvisible cirrus (SVC) due to their very small optical thickness (τ<0,03). Even if the presence of those clouds are linked to the water vapor located in the upper troposphere / lower stratosphere, the formation and properties of such clouds are not well known. In fact, the role of large scale and small scale dynamics of the atmosphere (advection, overshoots, ...) as well as water vapor saturation is not yet clearly defined. To better understand the processes responsible for the formation of SVC, we have studied SVC observed by the embedded space lidar CALIOP over tropical area (-30° S/30° N). 3 years of CALIOP observations (June 2006 – December 2008) have been used to conduct statistical studies of such clouds. Roughly 6900 SVC have been found and studied. We first focus on mean temperatures, vertical thickness, altitudes and longitudes of SVC to better understand their spatial distributions. We then used 15 days back-trajectories (BT) using the FLEXPART software to follow the behavior over time of air masses leading to SVC formation. A stability criteria has been defined based on the mean temperature standard deviation for each BT leading to a cloud. Thus, a SVC has been defined as stable for a variation smaller than 2°K. Thus, 750 SVC (over 6900) was find as stable and split into different categories based on SVC temperatures (>195°K, 191°K-195°K, 188°K-191°K, 183°K-188°K). Optical properties as for instance depolarization ratio, were studied to better classify those SVC (NAT, STS, ICE, ...). Thus, we will present the first results of those studies. Geographical distributions (Asia, Africa, America, Pacific and Himalaya spots) of 15 days stable BT leading to SVC as well as optical properties combined with temperature categories.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
181.	Dr. Jérôme Riedi *Laboratoire d'Optique Atmosphérique - University Lille 1*	Remote Sensing of Cloud Properties from the A-Train : Lessons learned from 5 years of coincident POLDER and MODIS data in light of CloudSat/Calipso observations.	Talk	The A-Train observations provide an unprecedented opportunity for the production of high quality dataset describing cloud cover properties. We illustrate in this study the lessons learned from 5 years of coincident POLDER (Polarization and Directionality of the Earth Reflectance) and MODIS (MODerate Resolution Imaging Spectroradiometer) data in view of observations from the CALIOP (Cloud-Aerosol Lidar with Orthogonal Polarization) and CPR (Cloud Profiling Radar) active sensors. Among the different cloud properties derived from POLDER and MODIS observations, we will illustrate the retrieval of cloud microphysics and cloud vertical structure. Particular focus will be made on cloud thermodynamic phase and its relation with microphysical and thermodynamic parameters. Phase of condensed atmospheric water and its relation with main thermodynamic parameters plays a critical role in the formation and evolution of clouds. Cloud particle microphysics is a first order parameter for computation of radiative exchange. It also governs strongly clouds lifetime through precipitation and sedimentation processes linked with particle size and shape and therefore phase. Not surprisingly, the representation of condensed water thermodynamic phase in models is a major source of uncertainty for the evaluation of clouds and water vapor feedbacks in an evolving climate. Therefore, there is a critical need to better describe the distribution of condensed water between ice and liquid phase in clouds, and the relations with main thermodynamic parameters that governs this partitioning. As with many other problems, satellite observations are of outermost importance for the establishment and validation of relationship that exist between cloud phase and other atmospheric parameters. The existing methods for determination of cloud phase from passive spaceborne observations however, are subject to biases that can be strongly correlated to cloud microphysics, vertical structure and temperature. Establishing robust and unbiased relations between cloud phase and other thermodynamic parameters thus requires an extremely accurate phase determination independently of other atmospheric parameters. This can be achieved for instance by combining information from various sources in order to increase the confidence in cloud phase retrievals. A high confidence joint product has been derived from the 5 years of POLDER/Parasol and MODIS/Aqua coincident observational period. Quality of this dataset has been assessed against independent active observations from CALIOP and can be used as a benchmark for the evaluation of other cloud climatologies, for the assessment of cloud phase representation in models and the development of better cloud phase parametrization in GCMs. We analyzed in this study the frequency of occurrence of ice and liquid phase at cloud top as a function of temperature and other thermodynamic parameters. The study confirms at global scale the existence of liquid phase at very low temperature down to below 240 Kelvins as already observed in previous studies. More interestingly, this global high confidence dataset

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
182.	Dr. Laura D Riihimaki *Pacific Northwest National Laboratory*	Estimating TTL Cirrus Formation Mechanism Frequencies from CALIPSO Data	Poster	Tropical Tropopause Layer (TTL) cirrus clouds are formed either by direct injection of ice into the TTL through convective detrainment or by in situ ice nucleation under cold temperature fluctuations. The formation mechanism is thought to influence the cirrus properties and impact whether the clouds contribute to stratospheric dehydration. We group neighboring TTL cirrus profiles identified by CALIOP lidar measurements into cloud objects. TTL cirrus objects directly connected to deep convective clouds are assumed to be formed by convective detrainment, and the remaining non-convective TTL cirrus objects are assumed to contain a mixture of TTL cirrus formed in situ and aged anvil that has outlived its generating convection. We compare the frequency of convective TTL cirrus defined using this object-classification method to the frequency of convective TTL cirrus identified from back trajectory calculations in order to better understand the limitations of the two formation mechanism estimates. The object-classification method is a relatively quick way to determine formation mechanism, and so is a useful tool for examining correlations between formation mechanism and atmospheric variables.
183.	Emily M Riley *University of Miami*	Clouds associated with the MJO: A new perspective from CloudSat	Poster	This study uses two years (June 2006 – June 2008) of CloudSat data to characterize clouds associated with the Madden Julian Oscillation (MJO). Two approaches are used to define the MJO. The first defines eight MJO phases relative to minima, maxima, and min-slope, max-slope conditions in filtered outgoing longwave radiation (ORL). The second approach also defines eight MJO phases, but this time phases are defined using Wheeler and Hendon's (2004) Real Time Multivariate MJO (RMM) index. In each approach, composites of cloud statistics are made for each phase. Cloud statistics include: identification of cloud types, total cloudiness, anomalous cloud cover, and temperature and moisture profiles per phase. In addition to these bulk statistics, we keep track of individual cloud objects (i.e. echo objects) to construct pictorial realizations of actual (i.e. CloudSat observed) clouds across the MJO. The pictorial realizations are attempts to mimic schematics from previous works (e.g. Madden and Julian 1972, Morita et al. 2006, and Benedict and Randall 2007). The hope of this work is to challenge pre-conceived ideas of cloud structure across the MJO based on new findings from CloudSat. This observationally based work can be a useful tool and/or target for understanding and improving convective parameterization deficiencies in models.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
184.	Dr. Raymond Rogers *NASA*	Validation of CALIOP Level 2 Products Using Airborne High Spectral Resolution Lidar Data	Poster	The NASA Langley airborne High Spectral Resolution Lidar (HSRL) has been deployed on 100 coincident underflights of the CALIPSO satellite track. In addition to acquiring the same fundamental measurements made by CALIOP (attenuated backscatter at 532 and 1064 nm and total depolarization at 532 nm), the airborne HSRL provides an independent and unambiguous measurement of extinction at 532 nm as well as an additional depolarization measurement at 1064 nm. In this poster we present both statistical and profile-by-profile comparisons with CALIOP Level 2 532 nm aerosol extinction and backscatter profile products and an assessment of CALIOP extinction-to-backscatter ratio assignment. We also present an assessment of the CALIOP Level 2 532 nm aerosol optical depth (AOD) and use the MODIS AOD to interpret the HSRL and CALIOP measurements on a case study.
185.	Prof. William B Rossow *City College of New York*	Relating Cloud Vertical Structure to Weather-scale Circulations	Poster	Recent observations by satellite-bourne cloud radar (CloudSat) and lidar (Calipso), complemented by a variety of other profiling instruments (e.g., AIRS, MLS and the TRMM precipitation radar), provide a globally comprehensive, yet detailed, look at the vertical structure of cloud formations. The first results quantify more precisely the classical morphological classification into cumuloform and stratiform cloud types, the former having horizontal to vertical extent ratios of order 1 to 10 and the latter having ratios much larger than 10. These two cloud types are readily apparent in the distribution of cloud layer thicknesses with cloud top heights. Combining this new information with satellite imager cloud characterizations shows some success in associating cloud vertical structure with optical properties, especially for cloud systems with cloud tops in the upper troposphere. However, associating cloud vertical structures with point-measurements of cloud optical properties appears to be the wrong spatial scale (too small) for such a relationship to hold. The reason to combine these two views of clouds is to relate the cloud structures observed by sparsely-sampled measurements to the dynamical evolution of cloud systems that can be observed with imagers. Results are presented from an investigation of cloud vertical structure and other cloud properties on mesoscale-to-synoptic scales.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
186.	Dr. Itaru Sano *Kinki University*	Retrieval of biomass aerosols with combination analysis of near UV and polarization data	Poster	Carbonaceous aerosol plays an important role not only in climate but also in aerosol study. It is, however, difficult of modeling the biomass burning aerosols because their properties are widely varied and strongly dependent on the biomaterial itself, stage of burning, and/or transportation process such as water vapor uptake. It is of interest to mention that the carbonaceous aerosols in general absorb the UV radiation. This fact looks to be available to retrieve the biomass aerosols from the data given by TOMS and OMI. Greenhouse gases observing satellite (GOSAT) was launched in January 2009, which carries two sensors, Fourier Transform Spectrometer (FTS) and Cloud and Aerosol Imager (CAI). The CAI is a complimentary sensor to observe the both cloud and aerosol particles at four wavelengths from near UV (0.38 um) to short infrared (1.6 um) with the 500 m pixel resolution. The measurements at 0.38 um have advantages of detection of carbonaceous aerosols and less ground surface reflection in comparison with the visible bands. The combination use of the measurement by 0.38 um and that of 0.41 um by MODIS give the information of absorbing particles. Polarization and Directionality of Earth's Reflectances (POLDER) measures the directional polarization feature with semi-Stokes vector (I, Q, and U) at 0.49, 0.67, and 0.87 um. The polarization information by POLDER has the big advantages to retrieve aerosol properties, especially for fine mode aerosols. This work intends to estimate the optical properties of biomass burning aerosols based on the combined use of CAI, MODIS and POLDER data. Simultaneous measurements by CAI, POLDER, and also MODIS/Aqua are rather restricted because the CAI is operating in a different orbit from the A-train sensors'. However, Siberian biomass burning plume was observed with all of sensors at the end of July of 2009. As results, aerosol optical thickness (AOT) and a single scattering albedo (SSA) at a wavelength 0.55 um have been retrieved. It is found from these results that AOT takes the values larger than ~3 over the plume, and the values of SSA take from 0.9 to 0.85 in the plume. It is of interest to mention that this fact might suggest the changing of aerosol properties according with water vapor uptake during the transportation.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
187.	Parnchai Sawaengphokhai *SSAI*	The Assessment and Use of 1-Degree Gridded TOA and Surface Radiative Flux Products from CERES FLASHFlux	Poster	The NASA Langley Research Center Fast Longwave And SHortwave Radiative Fluxes (FLASHFlux) project is producing global near real-time surface and top of Atmosphere (TOA) radiative fluxes and analyzing these quantities and their variability on regional and global scales. This is being accomplished by using a portion of the existing Clouds and the Earth's Radiant Energy System (CERES) processing system with several modifications to increase processing speed. The subsystems process CERES and Moderate Resolution Imaging Spectroradiometer (MODIS) observations from Aqua, in the A-Train constellation, and Terra platforms that are subsequently blended using time and space averaging techniques to obtain the global gridded products. The FLASHFlux processing system also uses meteorological information from NASA Global Modeling and Data Assimilation Office (GMAO) Goddard Earth Observing System (GEOS) operational analysis version 5.2. The production of these together considering the latency times results in the surface radiative fluxes within 6-7 days of the original satellite observations. These products are providing reliable estimates of global TOA and surface radiative fluxes in near real-time during the temporal gap between actual satellite observations and the time until highly accurate CERES flux estimates become available 6-12 months later. This paper provides an assessment of 1-degree gridded TOA and surface radiative fluxes between highly accurate CERES radiative flux products and CERES FLASHFlux radiative flux products. Using these comparisons, an overview of the flux uncertainty is provided for the CERES FLASHFlux products. Additionally, we compare CERES FLASHFlux products with other A-train satellite instruments products and other satellite products to evaluate monthly anomalies.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
188.	Mathias M Schreier *JIFRESSE/UCLA - JPL*	Impacts of cloud heterogeneity on infrared thermodynamic phase assessment	Poster	A combination of collocated Atmospheric Infrared Sounder (AIRS) and Moderate Resolution Imaging Spectroradiometer (MODIS) radiances and cloud products are used to quantify the impact of cloud heterogeneity on AIRS-based assessments of cloud phase. The spatial collocation is rigorously determined from prelaunch calibration measurements of the AIRS spatial response function (Schreier et al., 2010) and is demonstrated to be an essential prerequisite for the accurate determination of AIRS pixel-scale cloud heterogeneity. Previously, simplified radiative transfer experiments demonstrated that the AIRS channels have a higher sensitivity to cloud phase when compared to MODIS channels in similar spectral bands (Nasiri and Kahn, 2008), but relative trade-offs in sensor resolution differences were not considered. Here, relatively homogeneous clouds with window brightness temperatures from 250–265 K are shown to have larger cloud phase signatures than heterogeneous clouds. Furthermore, a higher frequency of homogeneous clouds is shown to occur in the high latitudes where large numbers of unknown and mixed-phase clouds reside. Two-dimensional histograms of channel differences sensitive to particle size (960–857 cm–1), cloud phase (1231–960 cm–1), and water vapor amount (1231–1227 cm–1) show a distinct separation between many homogeneous and heterogeneous clouds. These results illustrate a quantitative approach for using a combination of hyper-spectral sounders with high-spatial-resolution imagers to not only improve infrared-based assessments of cloud phase, but also to improve the characterization of different cloud and aerosol regimes by quantitative measures of scene heterogeneity.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
189.	Dr. Genevieve Seze *LMD/ IPSL/UPMC*	Evaluation of the Global 3-D Cloud Cover distribution obtained fromMulti-Geostationnary data with CALIPSO lidar observations in the tropical belt.	Poster	Cloud vertical distribution is conditionning radiative heating and latent heat release profiles which are essential to the energy redistribution in the atmosphere. A good knowledge of its variations at global and regional scale is important, more particularly taking into account the diurnal cycle. These last years, the CALIPO lidar and CloudSat radar active measurements and the AIRS and IASI sounders mesurements with improved spatial resolution have brought new observations of the cloud cover distribution. However, these LEO mesurements can not observe the full diurnal cycle of the cloud cover. The geostationary satellite data remain the only data set allowing such observation at middle and low latitude, but the quality of the vertical distribution of the retrieved cloud coverdepends on the multispectral capability of the instruments and the spatial resolution of the observation. as well as its temporal sampling. A good understanding of the characteristics of these geostationnary data sets is important. It is moreover necessary to use the same analysis method. Comparison of the cloud cover parameters obtained with simultaneous active CALIOP lidar and/or CloudSat radar measurements is an important step as it provides independent observations which can be used in reference. This can allow to analyse potential limitations of the VIS-IR geostationnary data set and further lead to improvements in the analyses performed with these data sets, as done in the frame of ISCCP. Here we show first results from such an approach using the retrieval method developed by the SAFNWC (Legleau and Derrien, 2005; Derrien and Legleau, 2009) for the multi-spectral SEVIRI radiometer on board METEOSAT second generation, and also apply it to GOES-E, GOES-W and MTSAT satellite data. This four set of geostationary data allows to retrieve cloud parameters with a one hour time sampling over a large part of the tropical belt (35°S -35°N). For a three month period in summer 2009, cloud mask, cloud type classification and cloud top pressure products from these four satellite data set have been analysed using ther cloud layer structure observed with the lidar CALIOP (product layer Version 3). First results of this evaluation study are presented. For each geostationary satellite the mean cloud cover and instantaneous cloud cover is compared to CALIOP cloud cover for a three month period. Day and night, land and ocean are studied separately.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
190.	Yohei Shinozuka *Bay Area Environmental Research Institute*	Horizontal variability of aerosol optical properties observed during the ARCTAS airborne experiment	Poster	The properties of tropospheric aerosol and gas vary within a satellite grid cell and between ground-based instruments. This hinders comparison between satellite and suborbital measurements of different spatial scales as well as their applications to climate and air quality studies. This paper quantifies the realistic range of the variability in aerosol optical depth (AOD), its Angstrom exponent, in-situ extinction coefficient and carbon monoxide mixing ratio over horizontal distances of 1-30 km, using measurements from the ARCTAS airborne experiment. The Canada phase in June and July 2008, in which smoke from local forest fires was sampled, likely represents the most heterogeneous of the ambient aerosol environments common over the globe. The relative standard deviation (stdrel) of AOD measured with the 14-channel Ames Airborne Tracking Sunphotometer (AATS-14) has median 19.4% (at 499 nm) among thousands of horizontal 20 km segments. For 6 km segments the analogous median is 9.1%. Another measure of horizontal variability, the autocorrelation (r) of AOD499 across 20 km and 6 km segments is 0.37 and 0.71, respectively. In contrast, the Alaska phase in April 2008, which sampled particles transported from Asia, is presumably among the most homogeneous environments. The median stdrel is 3.0% and r is 0.90, both over 30 km, only slightly different from those for 1 km (stdrel=0.4% and r=1.00). r in the Canada phase is ~0.2 less for in situ extinction coefficient (from a nephelometer and a particle soot absorption photometer) than for the AOD. It is ~0.1 less than for the carbon monoxide mixing ratio. The trends of horizontal variability with distance and aerosol environment are different for the wavelength dependence and the humidity response of light scattering. We discuss challenges in estimating aerosol optical properties, particle size and chemical composition from measurements at a distant location. The statistical parameters thus help interpret existing remote-sensing observations and design future ones.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
191.	Dr. Alexander Sinyuk *Sigma Space Corp.&NASA/GSFC*	Improving accuracy of aerosol single scattering albedo retrieved from AERONET observations taken at high sun elevations.	Poster	AERONET is the federated network of ground based sun-photometers routinely performing sun and sky radiance measurements at more than 200 locations all over the world. Along with aerosol optical depth (AOD) observations, AERONET aerosol retrieval algorithm delivers the complete set of aerosol parameters including single scattering albedo (SSA) which is an imperative quantity in understanding of aerosol radiative forcing. The current version of AERONET aerosol retrievals consider SSA retrievals to be of level 2 only if the following conditions are met: AOD at 440 nm is larger than 0.4 (enough sensitivity to aerosol absorption is assured) and solar zenith angle (SZA) is larger than 50 degrees (to ensure the big enough range of scattering angles). Restrictions on SZA make it difficult to use level 2 SSA retrieved during or close to the time of satellite overpass (SZA normally is smaller than 50 degrees) by satellite community. The accuracy improvement is achieved by inverting combing data set consisting of almucantar and principal plane observations taken 6 minutes apart. In the combined data set only the part of principle plane which complements almucantar in terms of scattering angles is used. It allows keeping the same control of observation quality as for almucantar measurements. The technique was tested for number of AERONET sites dominated by aerosol loading of different type. It is demonstrated that the SZA threshold for SSA quality retrievals is the function of aerosol particles size: from ~ 15 degree (Angstrom exponent > 2) to ~ 30 degree (Angstrom exponent <0.2).

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
192.	Dr. Gail Skofronick-Jackson *NASA Goddard Space Flight Center*	Passive Microwave Retrievals of Falling Snow During C3VP as Compared to CloudSat	Poster	Passive Microwave Retrievals of Falling Snow During C3VP as Compared to CloudSat Gail Skofronick-Jackson1, Benjamin Johnson2, James R. Wang3 1Mesoscale Processes Branch, Code 613.1, NASA Goddard Space Flight Center, Greenbelt, MD Gail.S.Jackson@nasa.gov 2University of Maryland Baltimore County (JCET/GEST) 3SSAI, Lanham, MD Abstract for A-Train Meeting October 2010 Prefer POSTER Presentation Prefer to be in the same session as Benjamin T. Johnson et al., "Physically-Based Snowfall Retrievals Using CloudSat Radar Reflectivities" Retrievals of falling snow from space represent one of the next important challenges for the atmospheric, hydrological, and energy budget scientific communities. Estimates of falling snow must be captured to obtain the true global precipitation water cycle, snowfall accumulations are required for hydrological studies, and without knowledge of the frozen particles in clouds one cannot adequately understand the energy and radiation budgets. Historically, retrievals of falling snow have been difficult due to the relative insensitivity of satellite rain-based channels as used in the past. We emphasize the use of high frequency passive microwave channels (85-200 GHz) since these are more sensitive to the ice in clouds. In addition, these radiometers have large footprints as compared to CloudSat and thus provide more coverage over the scene of view. We compare the passive falling snow detection and retrieval results to the CloudSat W-band reflectivities that are also sensitive to snowfall signatures. This analysis relies on data from the Canadian CloudSat/CALIPSO Validation Program (C3VP) field campaign held from October 31, 2006 through March 1, 2007. The C3VP field campaign provided an opportunity for the CloudSat/CALIPSO and GPM mission teams to participate in cold-season northern latitude data collection activities. The field campaign was heavily instrumented on the ground, with aircraft, and with CloudSat and AMSU-B satellite overpasses. Our passive microwave retrievals take two forms, empirically-based (using C3VP data) and physically-based Bayesian (using WRF modeled data). We have found that the surface emission (~emissivity*Tsurf) contributes to the TB seen from space in both cases. This surface emission (if not accounted for) can contaminate the TB signal from the atmospheric falling snow and cause errors in the retrievals. Our work shows that there are difficulties in adequately estimating the surface emission and environmental profiles, however, falling snow detection retrievals are making progress and compare favorably to CloudSat imagery. The C3VP data set is especially challenging since the climatology supports shallow snow cloud events and light synoptic frozen precipitation. These shallower/light storms do not necessarily provide enough TB signal to noise ratio between the atmospheric snow signal and the surface emission/environmental profile noise. We will report our current status on both the C3VP empirical detection results,

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
193.	Susan Sorlie *ASDC*	A-Train Data Products Available from the Atmospheric Science Data Center	Poster	The Atmospheric Science Data Center (ASDC) at the NASA Langley Research Center archives and distributes data from several A-Train data sources including CERES, TES, and CALIPSO. This poster will provide a description of these data products available from the ASDC along with information about our data access methods including value-added tools such as the newly released CALIPSO Subsetter.
194.	Mr. Odran Sourdeval *LOA*	Validation of Infrared Imaging Radiometer (IIR/CALIPSO) measurements by comparison with airborne observations (CLIMAT-AV) during the "Validation CALIPSO" and "CIRCLE-2" campaigns	Poster	Because of their important spatial and temporal coverage, cirrus clouds are considered of having a major but still badly determined influence on global climate and radiative phenomena in the atmosphere. Numerous studies have been performed during the last decades in order to enhance our knowledge of their global impact on the Earth-ocean-atmosphere energy balance. However, due to their high altitude precise observations are still seldom, especially using aircrafts. Consequently, the use of spatial data from instruments dedicated to climate studies such as IIR/CALIPSO occurs to be of primal importance. During May 2007 and October 2008, the “CIRCLE-2” and “Validation CALIPSO” campaigns were conducted with the intention to study cirrus clouds microphysical properties (optical thickness, ice crystal shape and effective diameter), but they also took place as the first validation campaigns of IIR. In this study, we compare radiative measurements performed by the CLIMAT-AV infrared radiometer onboard a FALCON-20 aircraft to those of IIR. The aircraft was also equipped with the LEANDRE lidar and in situ measurements instruments. The spectral ranges of the channels of CLIMAT-AV radiometer are highly similar to the ones of IIR in order to make data comparable. Good correlations are found between IIR and CLIMAT-AV measurements. Afterwards, inversions of cirrus optical thickness and crystals effective diameters are attempted, using the FASDOM radiative transfer code and an optimal estimation method. These inversions are then compared to in situ observations and also to IIR operational products. We retrieve optical thickness and crystal effective diameter values close from in situ observations.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
195.	Dr. Ryan Spackman *NOAA ESRL Chemical Sciences Division*	Pole-to-Pole Observations of Black Carbon Aerosol with Applications to A-Train Satellite Validation	Poster	Efforts are now underway to expand global measurements of black carbon (BC) aerosol from aircraft and satellite to better assess the impact of fossil fuel combustion and biomass-burning sources of BC on global air quality and climate. Understanding the processes controlling BC aerosol abundance in the atmosphere is necessary to constrain transport and microphysics in global aerosol models, evaluate climate impacts, and develop mitigation strategies. Recent measurements from the HIAPER Pole-to-Pole Observations (HIPPO) study provide several snapshots of the global distribution of BC and greenhouse gas species at finer spatial resolution than obtainable from satellite measurements with the goal of assessing emissions, transport timescales, and removal processes. The HIPPO campaigns included ~140 vertical profiles in the remote Pacific and Arctic from 0.3 to as high as 14 km altitude in each of three missions covering three seasons between 85°N and 67°S latitude. Two additional HIPPO missions will occur in 2011. This unique dataset will be useful for validation of A-Train satellite retrievals when the aircraft data are analyzed in the appropriate meteorological context. We focus here on measurement highlights of BC mass loadings from the HIPPO missions and then show how these observations might be used for validation of the Glory satellite that will soon join the A-Train. Highlights from HIPPO include observations of stratified pollution in the Arctic, very polluted conditions in large-scale plumes from Asia in the north Pacific, and large interhemispheric gradients with some of the first airborne observations of BC mass loadings in the southern hemisphere.
196.	Mr. Christopher J Spells *Hampton University Graduate Student*	Characterization of the Saharan Air Layer (SAL) from Radiosonde and Satellite Data over the Tropical Atlantic	Poster	The Saharan Air Layer (SAL) is a layer of warm, desiccated, dusty air which normally overlays the cooler, more humid surface air of the Atlantic Ocean. Over the Saharan Desert, air moving across the desert becomes warm and dry forming a deep mixed layer in the troposphere. Dust layers can extend from 1.5 km - 6.0 km in the atmosphere, can travel approximately 8o-10o longitude per day, and be traced as far west as the West Indies and Gulf of Mexico. In this poster, monthly mean temperature and relative humidity over the tropical North Atlantic Ocean (0o- 30oN) are examined from four years of FORMOSAT-3/Constellation Observing System for Meteorology, Ionosphere & Climate (COSMIC) data, for the months of June- September. Temperature and humidity measurements from radiosondes launched during the trans-Atlantic Aerosol and Ocean Science Expeditions (AEROSE) are also examined. The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite is used to characterize the vertical distribution of the aerosol layer and discriminate between aerosol types. Additionally, NOAA HYSPLIT trajectory modeling is employed in an effort to characterize dust transport paths across the Atlantic.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
197.	David Starr *NASA Goddard Space Flight Center*	NASA's Aerosol-Cloud-Ecosystems (ACE) Mission: Science Goals and Implementation	Poster	The Aerosol-Cloud-Ecosystem (ACE) mission was recommended by US National Research Council (NRC) Decadal Survey in 2007. NASA assembled a team of scientists and engineers, the ACE Science Working Group, who have worked over the past 2 years to further develop the mission concept, provide a detailed scientific rationale, and develop a traceable implementation strategy for this Tier-2 DS mission that directly addresses key climate change issues. The results will be summarized here. ACE is designed to substantially advance the state of aerosol, cloud and ocean ecology science by providing global data sets of unmatched accuracy and substantially improved information content to enable a major step forward compared to what is presently known, or possible with present capabilities. ACE will be the successor to the A-Train and EarthCare as regards global aerosol and cloud data products. Driving the approach for ACE is the goal to substantially reduce the uncertainty in climate forcing associated with aerosol-cloud interactions, including precipitation, and to markedly advance knowledge of ocean ecosystem, and its CO2 uptake, though synergistic use of advanced aerosol characterization in the retrieval of ocean ecosystem parameters. To do these things, ACE is designed to take advantage of new and emerging capabilities to dramatically enhance knowledge of the contents of these components, specifically aerosol properties, cloud microphysics, and marine biosphere properties that are not presently available, especially on a global basis. The present ACE mission implementation concept will be presented and the scientific rationale will be summarized. How these science objectives and measurement requirements translate into nominal instrument requirements will be briefly described. At present, ACE is envisioned to include a multi-angle spectral polarimeter, a multi-wavelength High Spectral Resolution Lidar (HSRL), a dual-frequency cloud radar, and a multi-band spectral radiometer. The polarimeter is primarily focused on aerosol and cloud requirements while the spectral radiometer is mostly focused on ocean ecology measurements. The lidar provides a major step forward for aerosol science and also offers new capabilities for ocean ecology. The dual-wavelength radar is essential to quantifying microphysical profiles, where the effects of aerosol-cloud interaction are most explicit, and which will provide new insights into global cloud processes. The current ACE concept also calls for radiometer measurements in the infrared, microwave and submillimeter spectral regions to quantify cloud properties at sufficient accuracy and to provide a relatively complete picture of the local components of the atmospheric hydrologic cycle, necessary to describe cloud processes and their interactions.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
198.	Prof. Graeme L Stephens *Jet Propulsion Laboratory*	The A-Train: A unique view of the Earth System	Talk	The A-Train provides a unique view of the Earth system through the eyes of different sensors each viewing different aspects of the evolving system. When combined, these observations have provided a number of unexpected new capabilities that are now revealing new insights on the composition of the atmosphere and the planets water cycle as well as how these in turn link to the climate system through their influence on the Earth's energy balance. This talk will highlight a number of new unexpected findings derived from multi-sensor A-Train data and will emphasize how these observations are advancing our modeling of the Earth and climate change.
199.	Joshua Stodghill *DEVELOP National Program*	Tracking Kilauea Volcano Sulfur Dioxide Emissions throughout the Big Island of Hawai'i to Increase Public Awareness	Poster	Volcanic smog (vog) emissions, which include sulfur dioxide (SO2) from Mt. Kilauea on the Big Island of Hawai'i pose health risks to locals and visitors to the island due to the rising SO2 concentration levels in the air and plume dispersion and deposition. An eruption in 2008 at the summit of the volcano slowed SO2 emissions at the east rift vent, but SO2 output at the summit vent has increased. This altered the aerosol concentration and disbursement of the vog thereby elevating the atmospheric exposure of SO2 to locals and visitors on the southeastern side of the island. By developing new methods using remote sensing and models for monitoring SO2 concentrations one could increase the understanding of SO2 and its hazards and could improve public health awareness. To estimate SO2 concentrations and deposition throughout the island, this project used a Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) point source dispersion model. The objective of this research was to produce a methodology utilizing HYSPLIT deposition modeling and OMI data that can be used to further public awareness of the health hazards of SO2 emissions. HYSPLIT concentration models were compared to ground based sulfur dioxide concentration data to support future utilization of HYSPLIT modeling to predict SO2 emissions. NASA's Aura OMI and Aqua MODIS were used to monitor and track volcanic sulfur dioxide plumes on a broad scale.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
200.	Prof. Trude Storelvmo *Yale University*	Combined observational and modeling based study of the relationship between aerosols and supercooled cloud fraction	Poster	Recent observational and modeling studies indicate that aerosols may have a strong effect on Earth's energy budget via their influence on mixed-phase clouds. Global climate studies have predicted aerosol interaction with mixed-phase clouds to warm the current climate, but estimates are uncertain because mixed-phase cloud processes in GCMs are highly parameterized and have to date been poorly constrained by satellite data. Here, we present global and regional distributions of the frequency of supercooled cloud water and its link to aerosols from two global climate models (GCMs), compared to a new satellite data set. Both GCMs link ice formation at temperatures between -40 and 0 degrees C to the simulated concentrations of aerosols with ice nucleating ability (IN), assigning different freezing efficiencies to the different insoluble aerosol species (mineral dust, bio-aerosols and soot). Consequently, both models generally simulate an anti-correlation between aerosol abundance and supercooled liquid water in clouds, a finding that was recently qualitatively confirmed by satellite observations. By studying the relationship between aerosols and the supercooled cloud fraction (SCF) from the GCMs and from the NASA spaceborne lidar instrument CALIOP (cloud-aerosol lidar with orthogonal polarization), we get strong indications of how aerosols may influence mixed-phase clouds. Furthermore, based on the guidance from the satellite data, we perform global simulations of the radiative effects associated with aerosol influence on mixed-phase clouds. We argue that with the new validation of SCF and its link to aerosols, GCM estimates of aerosol effects on climate via their influence on mixed-phase clouds have become more reliable.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
201.	Dr. Claudia J Stubenrauch *LMD / IPSL / CNRS*	Global Cloud Climatologies from satellite-based InfraRed Sounders (TOVS, AIRS, IASI) + AIRS-CALIPSO-CloudSat Synergy	Talk	We present a seven-year global climatology of cloud properties, obtained from observations of the Atmospheric Infrared Sounder (AIRS) onboard the NASA Aqua satellite. Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) combined with CloudSat observations, both missions launched as part of the A-Train in 2006, provide a unique opportunity to evaluate the retrieved AIRS cloud properties such as cloud amount and height. In addition, they permit to explore the vertical structure of different cloud types. AIRS-LMD cloud detection agrees with CALIPSO about 85% over ocean and about 75% over land. Global cloud amount has been estimated from 66% to74%, depending on the weighting of not cloudy AIRS footprints by partial cloud cover from 0 to 0.3. 42% of all clouds are high clouds, and about 42% of all clouds are single layer low-level clouds. The 'radiative' cloud height determined by the AIRS-LMD retrieval corresponds well to the height of the maximum backscatter signal and of the 'apparent middle' of the cloud. Whereas the real cloud thickness of high opaque clouds often fills the whole troposphere, their 'apparent' cloud thickness (at which optical depth reaches about 5) is on average only 2.5 km. The real geometrical thickness of optically thin cirrus as identified by AIRS-LMD is identical to the 'apparent' cloud thickness with an average of about 2.5 km in the tropics and midlatitudes. High clouds in the tropics have slightly more diffusive cloud tops than at higher latitudes. In general, the depth of the maximum backscatter signal increases nearly linearly with increasing 'apparent' cloud thickness. For the same 'apparent' cloud thickness optically thin cirrus show a maximum backscatter about 10% deeper inside the cloud than optically thicker clouds. We also show that only the geometrically thickest opaque clouds and (the probably surrounding anvil) cirrus penetrate the stratosphere in the tropics. In addition, we explore microphysical properties of semi-transparent cirrus, retrieved from. cirrus emissivities between 8 and 12 micron.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
202.	Dr. Claudia J Stubenrauch *LMD / IPSL / CNRS*	GEWEX assessment of global cloud climatologies: cloud properties and their variation	Poster	Satellite observations provide a continuous survey of the state of the atmosphere over the whole globe. One GEWEX activity is to assess the quality and reliability of available global cloud data sets for climate studies (http://climserv.ipsl.polytechnique.fr/gewexca). GEWEX cloud products are provided by the International Satellite Cloud Climatology Project (ISCCP), using data from a combination of polar orbiting and geostationary imagers. There are two cloud analyses (HIRS-NOAA and TOVS Path-B) using TIROS-N Operational Vertical Sounder Operational (TOVS) observations onboard the NOAA polar orbiting satellites. The relatively high spectral resolution of these instruments provides reliable cirrus identification, day and night. Recently, the NOAA PATMOS-x project has reanalyzed the Advanced Very High Resolution Radiometer (AVHRR) data onboard the same satellites. Cloud occurrence climatologies using sun occultation measurements from the Stratospheric Aerosol and Gas Experiment (SAGE) and from surface observations also participate in the assessment, as well as analyses using the second generation instruments MODIS (Moderate Resolution Imaging Spectroradiometer), MISR (Multi-angle Imaging SpectroRadiometer) and AIRS (Atmospheric Infrared Sounder) aboard the NASA the Earth Observing System (EOS). Since summer 2006 data are available from two active instruments aboard the A-Train: the lidar of the CALIPSO mission and the CloudSat radar, giving for the first time a global insight on cloud layering. Recently, also cloud climatologies from PARASOL and ATSR (Along-Track-Scanning Radiometer) joined this project. Climatological averages of cloud properties, their regional, seasonal and diurnal variations as well as time series of these climatologies are presented. One outcome of this study was, that the different datasets compared better when high, midlevel and lowlevel cloud amount were scaled by total cloud amount. This approach might also be useful for comparisons with climate models. One should also remember that passive remote sensing gives only information on the uppermost cloud layer. About 40% of all clouds are high clouds (with a cloud pressure smaller than 440 hPa) and about 40% of all clouds are single-layer lowlevel clouds (with a cloud pressure larger than 680 hPa). Differences in relative high cloud amount (scaled by total cloud amount) can be mostly understood by different instrument sensitivities: the active lidar CALIPSO as well as limb sounding SAGE are the most sensitive instruments to very thin cirrus. The relatively high spectral resolution of IR sounders (TOVS/HIRS and AIRS) makes them the passive instruments most sensitive to cirrus. They only miss 10% and 5% of all high clouds in the tropics and midlatitudes, respectively (being subvisible cirrus). ISCCP misses further 15% and 10% of high clouds in the tropics and midlatitudes, respectively. These thin cirrus (often above lower clouds) are misidentified as midlevel clouds. The MODIS Science Team algorithm misidentifies some thin cirrus as lowlevel clouds. The seasonal cycles of the different cloud properties, however, agree very well.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
203.	Dr. Hui Su *Jet Propulsion Laboratory*	An A-Train View of Atmospheric Response to 2010 El Niño	Poster	The winter of 2009-2010 was characterized as a moderate-to-strong El Niño, with sea surface temperature (SST) anomalies over 1.5ºC in the central-eastern equatorial Pacific. The atmospheric response to this El Niño was captured by a suite of A-Train satellite instruments. CloudSat and Aura Microwave Limb Sounder (MLS) cloud ice measurements clearly showed the eastward shift of deep convection from the climatological western Pacific to central-eastern Pacific. The cloud ice in the upper troposphere (UT) increased more than 40% from the past 5-year mean at the peak of the El Niño. Associated with increased convection in the central-eastern Pacific, Aura MLS and Aqua Atmospheric Infrared Sounder (AIRS) water vapor measurements showed strong moistening in the UT. Near the tropopause, the central-eastern Pacific experienced cooling anomaly, while an abnormal warming in the western Pacific was observed, resulting in an increase of water vapor transport into the stratosphere. Thus, the 2010 El Niño contributed to an increasing trend in the stratospheric water vapor since Aura launch, from August 2004 to February 2010. Using the 2010 El Niño as an example, the dynamic and thermodynamic components of cloud and water vapor changes in response to the warming of sea surface are analyzed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
204.	Ms. Lin Su *LASP/University of Colorado at Boulder*	Modeling of Dust Aerosols Using a Coupled Climate-Aerosol Model and its validation using CALIPSO and AERONET Data	Poster	A three-dimensional coupled climate-aerosol microphysical sectional model based on the University of Colorado/NASA Community Aerosol and Radiation Model for Atmospheres (CARMA2.3) and the NCAR Community Atmosphere Model (CAM3) is used along with data to understand the similarities and differences between dust from Asia and dust from the Sahara. The simulated dust vertical distributions of Saharan and Asian dust are constrained by CALIPSO (lidar) measurements in 2006 and 2007. The size distributions and single scatter albedo of Saharan and Asian dust are validated by AERONET data in May and July 2007. Saharan deserts are largely south of 30N, while Asian ones are primarily north of 30N, hence they experience different meteorological regimes. Saharan dust lifting occurs all year long, primarily due to subtropical weather systems. However, Asian dust is lifted mostly in spring when mid-latitude frontal systems lead to high winds. Rainfall is more abundant over Asia during the dust lifting events, leading to greater local dust removal than over the Sahara. Asia also has more vegetation and snow cover, which suppresses dust lifting. As a result of these factors the yearly horizontal dust flux just downwind of the African dust source is about 1550 Tg (10S-40N, 10E) and from the Asian dust source it is about 420 Tg (25N-55N, 105E) in 2007. Despite the different meteorological regimes, the same dust lifting schemes work in models for Asian and the Saharan dust. Once lifted, the Saharan dust layers generally move toward the west and descend in altitude from about 7km to the surface over several days in the cases studied. Asian dust often has multiple layers (two layers in the cases studied) during transport. One layer stays well above boundary layer during transport and shows little descent, while the other, lower layer descends with time. This observation contrasts with studies suggesting the descent of Saharan dust is due to sedimentation of the particles, and suggests instead it is dominated by meteorology. While we find the size distributions of Asian and African dust are similar for similar distances from the source, the imaginary parts of the refractive indexes are different. This study is a step towards a global understanding of dust and its properties.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
205.	Dr. Wenying Su *Science Systems and Applications, Inc.*	Aerosol Indirect Effects from Satellite Measurements with Constrained Meteorological Analysis	Poster	Many studies have used satellite retrievals to investigate the effect of aerosols on cloud properties, but these retrievals are subject to artifacts that can confound interpretation. Additionally, large scale meteorological differences over a study region dominate cloud dynamics, and must be accounted when study aerosol and cloud interactions. We have developed an analysis method which minimizes the effect of retrieval artifacts and large-scale meteorology on the assessment of the aerosol indirect effect. The method divides an oceanic study region into 1° X 1° grid boxes, and separates the grid boxes into two populations according to back trajectory analysis: one population contains aerosols of oceanic origin, and the other population contains aerosols of continental origin. We account for variability in the large-scale dynamical and thermodynamical conditions by stratifying these two populations according to vertical velocity (at 700 hPa, ω700) and estimated inversion strength (EIS), and analyze the effects of oceanic and continental aerosols on cloud properties and top of atmosphere (TOA) albedos. We apply our method to a study region over the South Atlantic Ocean (0°—30°S and 15°W—10°E) and only consider single-layer low clouds. The back trajectory sorting of aerosols shows good agreement with expectation: aerosols associated with continental airmasses have larger AODs and Angstrom Exponent compared to aerosols associated with oceanic airmasses. We find that cloud properties and TOA albedo are strong functions of EIS and ω700 under constant AOD: cloud fraction, liquid water path and TOA albedo are larger in more stable conditions, but cloud droplet effective radius is smaller in more stable conditions. Our study also indicates that the magnitude of cloud property/albedo sensitivity to AOD is a strong function of both dynamic/thermodynamic regime and aerosol type. For oceanic aerosols, cloud droplet effective radius and liquid water path show greatest decrease with AOD under less stable condition. Opposite is true for continental aerosols. Cloud fraction and TOA albedo show greatest increase with AOD under more stable conditions for both continental and oceanic aerosols.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
206.	Ms. Xiaoli SU *Institute of Atmospheric Physics, Chinese Academy of sciences, Beijing*	Aerosol Variability over East Asia as seen by POLDER space-borne sensors	Poster	This paper is devoted to analyze aerosol distribution and variability over East Asia based on PARASOL/POLDER-3 aerosol products over land. We first compared POLDER-3 Aerosol Optical Depth (AOD) with fine mode AOD (particles radius ≤ 0.30 μm) computed from AERONET (Aerosol Robotic Network) inversions over 14 sites. The rather good correlation (R ≈ 0.92) observed over land demonstrates the remarkable sensitivity of POLDER-3 retrievals to the smaller fraction of fine particles, mostly originating from anthropogenic sources. We analyzed the characteristics and seasonal variation of aerosol distribution over East Asia considering four years of POLDER-3 Level 2 data (March 2005 to February 2009). Our study shows that the spatial distribution of fine-mode aerosols over East Asia, as retrieved from POLDER-3, is highly associated with human activities. Our work also evidenced a strong variability of seasonal fine-mode AOD patterns with geographical locations. Finally, the inter-annual variation during 2003-2009 periods of summer fine-mode AOD over North China, in particular the Beijing City region, was analyzed for the contribution to evaluating the regional impact of emission reduction enforced in Beijing during the 2008 Olympic Summer Games. We found that summer average of fine-mode AOD exhibited relatively higher values in 2003, 2007 and 2008. The inter-annual variation patterns of monthly averaged AOD (June to August) shows that June generally exhibits the strongest variation and varies similar to July, but differs from August. As reference, measured total AOD and fine mode AOD computed from AERONET inversions in summer are also discussed for the Beijing City region.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
207.	Dr. Moguo Sun *SSAI*	CERES ISCCP-D2like climate data product development	Poster	The Clouds and the Earth's Radiant Energy System (CERES) now has over 10 years observed TOA fluxes providing an accurate TOA flux record for climate monitoring and diagnostic studies for use in climate models. CERES provides the climate community both coincident CERES observed TOA fluxes and MODIS cloud properties. For climate community, CERES has packaged its MODIS derived cloud properties in the ISCCP-D2 monthly format, which can easily be substituted where-ever ISCCP D2 products are used, such as climate model diagnostics with ISCCP simulators. There are 4 CERES ISCCP-D2 like products, ISCCP-D2like-MODIS, ISCCP-D2like-GEO, ISCCP-D2like-Merge, and ISCCP-D2like-flux. The D2like-MODIS products have separated the MODIS day and nighttime cloud retrievals, where the nighttime retrievals are based only on IR channels. The MODIS product also includes the cloud infrared emissivity and particles sizes. To take into account the diurnal cycle between MODIS retrievals, CERES uses 3-hourly 5-satellite geostationary (GEO) clouds to infer the regional diurnal signal, in order to compute the daily mean cloud properties. The D2like-GEO contains only the GEO cloud properties. The D2like-merge product bins the Terra and Aqua MODIS clouds into GMT 3-hourly increments. In increments where no MODIS is available, GEO clouds are used. The GEO clouds are first normalized to the MODIS clouds to provide a consistent diurnal dataset. The ISCCP-D2like-flux product combines for the first time CERES measured TOA fluxes along with the associated MODIS cloud properties, which would link radiative flux directly to a specific cloud type. This presentation will focus on the normalization of the GEO cloud retrievals with MODIS and comparisons with the traditional ISCCP products. Also preliminary D2like-flux results will be shown.
208.	Dr. Wenbo Sun *Science Systems and Applications, Inc.*	Evaluation of MODIS aerosol cloud masks with CALIOP measurements	Poster	Aerosols are important components of the atmosphere and can significantly affect the radiative transfer and cloud processes in the climate system. A reliable retrieval of aerosol amount from satellite data requires accurate cloud mask information to avoid cloud contamination on the aerosol product. The cloud mask data for aerosol retrievals from passive instruments need to be evaluated by other measurements. In this study, the MOD04 aerosol cloud mask from the MODerate resolution Imaging Spectrometer (MODIS) on Aqua are compared with those from the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) on the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
209.	Dr. Kentaroh Suzuki *Colorado State University*	Multi-sensor analysis of warm cloud microphysical processes and its application to model evaluations	Poster	The recent emergence of CloudSat provides the first opportunity to observe the vertical cloud structure on the global scale. CloudSat is also designed to fly as part of the A-Train satellite constellation, which simultaneously observes various aspects of the cloud-to-precipitation processes. The combined use of the new multi-sensor observations offers a unique opportunity to obtain an entirely new insight into the warm cloud microphysical processes. In this presentation, we would like to highlight some recent attempts to combine the active and passive sensors of the A-Train for investigating several key aspects of the warm rain formation processes. The vertical cloud structure observed by CloudSat is combined with MODIS multi-wavelength analysis to obtain more detailed understandings of how the particle growth processes relate to rain formation. MODIS column optical thickness is vertically distributed between the cloud top and cloud bottom according to adiabatic and condensational growth assumptions and used as a vertical coordinate system to analyze profiles of CloudSat-observed radar reflectivity. The reflectivity profiles thus rescaled as a function of the in-cloud optical depth clearly depict how the cloud-to-rain particle growth processes take place within the cloud layer and how these processes vary systematically with variations in MODIS-derived effective particle radius. It is also found that the effective radii retrieved using two different wavelengths of MODIS tend to trace the microphysical change of reflectivity profiles in a different way because of the difference in the layer depth that characterizes these two effective radii. These analysis methods can also be applied to numerical cloud models and compared with the observations for evaluating the models. Notable in this regard is the recent emergence of the global cloud-resolving model NICAM. We have recently implemented the SPRINTARS aerosol transport model into NICAM and performed a global simulation of aerosol-cloud interactions with horizontal resolution of 7km, where clouds are represented in more explicit manner than conventional GCMs. Some results from the NICAM-SPRINTARS model, as well as from the regional cloud-resolving model RAMS, will also be presented and compared with the A-Train analysis mentioned above, and, in so doing, we would like to discuss how these comparisons can be used for evaluating the cloud parameterizations in the models and for better understanding the observed characteristics of warm rain processes.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
210.	Dr. Simone Tanelli *Jet Propulsion Laboratory*	CloudSat's Cloud Profiling Radar: Status, Performance, and data product changes in R05	Poster	In the first 4 years of flight operations, the CPR performance has met or exceeded all key science requirements: the radar's minimum detectable reflectivity ranges from -30 dBZ to -31 dBZ depending on the observed scene; analyses of the monthly CPR calibration and early under-flight validation data indicate that CPR radiometric accuracy is well within the pre-launch budget of 1.8 dB. Analysis of ocean surface backscatter at nadir and 10˚ incidence angle, and of selected land areas at nadir allowed to assess CloudSat's CPR absolute calibration and stability within 2 and 0.4 dB, respectively, and allowed to define a small corrective factor for the estimated transmit power and provides useful information to assess the accuracy of the gaseous absorption estimates. Development of the new experimental Brightness Temperature product allowed also to refine assessment of the receiver calibration and its temporal drift. This presentation will describe the evidence and the steps that led to the related upgrades in the L1B and L2B-GEOPROF products from R04 to R05 and will address the applicability of analysis techniques to the limits of radar measurements. We will report also on the status, performance and operations plans for CPR, with emphasis on the timing changes implemented in 2010. The research described in this paper was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.
211.	Mr. Qiang Tang *Stevens Institute of Technology*	COMPARISON OF MODIS, PARASOL AEROSOL OPTICAL DEPTHS OVER OCEAN WITH THE ONES DERIVED FROM COLLOCATED AMSR-E WIND SPEED AND CALIPSO OCEAN SURFACE BACKSCATTER	Poster	Through the relation between wind driven wave slope variance and sea surface wind speed, aerosol optical depths over the ocean are investigated by the use of lidar backscatter measurements from the CALIOP lidar deployed on the CALIPSO satellite in conjunction with collocated sea surface wind speed data from the AMSR-E instrument. The slope variance and wind speed relation can be used to derive an empirical sea surface backscatter after the correction of atmospheric attenuation and the removal of contributions from whitecaps and bubbles at the sea surface. Then we use the two-way transmittance relationship to derive the column optical depths. The aerosol optical depth derived from this method agrees with collocated MODIS and PARASOL measurements. The backscatter ratio of the 532 nm and 1064 nm channels can be used for calibration of the 1064 nm channel's signals. The backscatter ratio of the 532 nm channel can be used in conjunction with theory to calibrate the 532 nm channel's signals. Before the aerosol optical depth retrievals, the ocean surface signals obtained under cloud-free, ultra-low aerosol loading conditions and moderate wind speeds (7-9 m/s) are used for the lidar calibration corrections.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
212.	Dr. Didier TANRE *LOA/CNRS/Universite de Lille 1*	Derivation of tropospheric aerosol properties from A-Train observations	Talk	Atmospheric aerosols interact with solar and thermal radiation. By scattering sunlight and reflecting a fraction of it back to space, aerosols first cool the atmosphere-surface system. By absorbing sunlight in the atmosphere, they further cool the surface but warm the atmosphere. As a result, they change the temperature and humidity profiles and the conditions for cloud development. They also impact the cloud properties by acting as cloud condensation nuclei and ice nuclei. They modify the cloud droplet concentration and tend to decrease the droplet size, which may prevent or delay development of precipitation and modify the cloud albedo. For estimating the aerosol radiative forcing in climate models or for evaluating transport models, quantitative information on aerosol type and concentration is required at large scale. The A-Train satellite formation, which consists of presently five satellites flying in constellation, was specifically designed to measure aerosol, clouds and precipitation (http://aqua.nasa.gov/doc/pubs/A-Train_Fact_sheet.pdf). The combination of the multiple measurements of the A-Train is expected to better retrieve the aerosol parameters and to better understand the processes related to climate change. The contribution of the A-Train to specific questions concerning aerosols like: • the description of the global aerosol system with information on the temporal-horizontal-vertical distribution of aerosol type to provide constraints on climate models, • the quantification of the aerosol intercontinental transport, • the localisation and strength of aerosol sources, • or the aerosol contribution to global and regional radiative effects and climate forcing, will be illustrated.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
213.	Aleksandra Tatarevic *McGill University*	DAME Simulator: The New EarthCARE Doppler Cloud Profiling Radar Module	Poster	Within the preparatory studies related to the ESA's Earth Clouds Aerosol Radiation Explorer (EarthCARE) mission, the EarthCARE Instrument Simulator (ECSIM) has been developed. The ECSIM addresses the issue of forward and inversion modeling of active and passive instruments on board the EarthCARE satellite. The EarthCARE Cloud Profiling Radar (CPR) is the first space borne cloud radar with Doppler shift measurement capability. Mean Doppler velocity measurements are expected to provide an irreplaceable insight on microphysical and dynamical structure within clouds and precipitation. The Doppler Effect Modeling for Air Motion Estimates (DAME) research study emphasizes the detail representation of the parameters affecting the quality (errors and biases) in the space-borne Doppler velocity measurements. Data produced by a state-of-the-art, high-resolution cloud-resolving model (CRM) represent the basis for creating the different cloud and precipitation scenarios that will be used as input to various radiative transfer programs and instrument simulation modules. Particular attention is focused on the simulation of the Doppler spread due to the finite beam-width and satellite speed, cloud inhomogeneity within the illuminated volume and multiple scattering effects on the Doppler signal. The objective of the study is not only to provide the ability to simulate satellite overpasses and subsequent measurement processes, but also to allow for the interpretation and exploitation of radar Doppler measurements in cloud modeling and atmospheric sciences.
214.	Dr. Patrick C Taylor *NASA LaRC*	Investigating the Tropical TOA Radiative Diurnal Cycle using CERES	Poster	The diurnal cycle of precipitation is poorly represented in climate models. As a result, models likely misrepresent the diurnal cycle of cloud types and the associated cloud radiative effects (CREs). This effect can produce instantaneous errors in the shortwave CRE exceeding -100 W m-2 for an error in the time of convective maximum of only 2 hours, representing the need to characterize the diurnal cycle of cloud types and CREs, in a manner adequate to test climate models. The Cloud and Earth's Radiant Energy System (CERES) provides a Synoptic (SYN) product available at 3-hourly intervals including all sky and clear sky top of atmosphere, surface, and atmospheric fluxes and cloud properties. In this research, we use the CERES SYN data product to provide a diurnal cycle composite of tropical radiative fluxes. Further, the diurnal cycle of CERES SYN radiative fluxes and cloud properties will be sorted into dynamical regime using 500-hPa vertical velocities from the ECMWF interim reanalysis linking the large-scale tropical mean circulation and the tropical diurnal cycle.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
215.	Dr. Manu A Thomas *Swedish Meteorological and Hydrological Institute*	A global survey of aerosol-water cloud overlap based on four years of CALIPSO-CALIOP data	Poster	It can be argued that the most complex situations are present in the atmosphere when aerosols overlap highly reflective water cloud tops. Whether aerosols exert a net positive or negative direct radiative forcing is previously shown to be dependent on underlying cloud cover Therefore, a quantitative assessment of aerosol-cloud overlap is necessary not only to fully understand aerosol direct and indirect effects, but also to estimate the uncertainties in cloud property retrievals from passive remote sensing instruments. However, detecting aerosol-cloud overlap from the existing passive satellite sensors is extremely difficult and the quantification of overlap characteristics is not possible. One of the revolutionary advantages of CALIPSO-CALIOP sensor is that it enables us to quantify overlapping cases and their characteristics. For the first time, a global overview of aerosol-liquid water cloud overlap using four years of collocated CALIPSO-CALIOP cloud and aerosol products. We investigate seasonal variations in aerosol-cloud overlap frequency. We further examine characteristics of overlap events in terms of joint histograms of cloud layer top altitude and aerosol layer base altitude, and cloud and aerosol layer geometrical thicknesses in overlapping events. The results presented here will substantially contribute to the ongoing research in aerosol-cloud-climate interactions.
216.	Dr. Manu A Thomas *Swedish Meteorological and Hydrological Institute*	The vertical distribution and seasonality of aerosols over the Indian subcontinent: Insights from four years of CALIPSO-CALIOP data	Poster	Aerosol-climate interactions over the Indian subcontinent are under extensive research since the past few decades. Spatio-temporal heterogeneity in aerosol loadings and aerosol types over this region is very prominent with both natural and anthropogenic aerosols exerting their influence on the regional climate via direct and indirect effects. Precise mechanisms through which aerosols impact the regional climate, their relative importance, and a quantitative assessment of the nature of their impacts are not fully established yet. Observations of vertically resolved aerosol distributions are central in assessing their radiative effects and subsequently investigating various pathways through which aerosol-climate interactions would shape the hydrological cycle over the Indian subcontinent (0-40N, 60-100E). Here, we investigate aerosol height distributions over the entire Indian subcontinent using four years (Jun 2006 to May 2010) of CALIPSO-CALIOP 5 km Version 3 Aerosol layer products. We also examine seasonal variability in aerosol vertical distribution and day/night differences over the study area for six different aerosol types.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
217.	Kyle V Tietze *University if Utah*	Combining POLDER, MODIS and transport model data to quantify aerosol-cloud-radiation feedbacks in the Arctic	Poster	The synergy of the A-train satellite constellation allows channels from both MODIS and POLDER to be used in combination for a single cloud property retrieval, improving accuracy of Arctic cloud property retrievals in traditionally unfavorable conditions. Here, we explore the indirect effects of anthropogenic and biogenic aerosols on Arctic clouds by co-locating both vertically and horizontally A-Train cloud products with output from a chemical tracer transport model. Co-located cloud and pollution fields in the Arctic are compared for the spring and summer of 2008 during the activities of the International Polar Year field projects. We find a high sensitivity of Arctic cloud radiative properties to anthropogenic and biomass burning pollution plumes that is highest in the early spring and when cloud top temperatures are near freezing. Additionally we find that the cloud optical depth is more sensitive than the cloud effective radius to changes in pollution levels, both at very low as well as large liquid water paths. However, the sensitivity of clouds to pollution falls to near zero in the late spring to summer when cloud top temperatures exceed freezing. Presumably, as the weather warms, precipitation scavenging of CCN becomes highly efficient: while the pollution plumes remain, the CCN component that influences clouds has been removed. This result points to a temperature-mediated constraint on the extent to which the long-range transport of anthropogenic and biogenic pollution plumes can influence the radiative properties of clouds.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
218.	Omar Torres *Hampton University*	Improved OMI Aerosol Absorption Product using CALIOP and AIRS observations	Poster	The Ozone Monitoring Instrument (OMI) is one of four sensors on the AURA satellite. In addition to column ozone amount, the primary OMI product, and estimates of troposphere trace gas concentration (O3, SO2, NO2, Br0, HCHO), OMI also obtains information on aerosols and clouds taking advantage of unique sensitivities in the near-UV to cloud top pressure and aerosol absorption. OMI aerosol absorption detection capability is based on the interaction between the scattering and absorption processes. The unique near-UV aerosol signal, known as Absorbing Aerosol Index, picks up the presence of absorbing particulate (smoke, desert dust, volcanic ash) over all backgrounds, including snow/ice covered surfaces and above (or intermingled with) clouds. The inversion of the near-UV signal into quantitative aerosol absorption parameters is sensitive to aerosol layer height and, to a lesser extent, to the aerosol particle size associated with smoke and dust particles. The availability of aerosol layer height from CALIOP measurements and on CO column amounts by the AIRS sensor on the AQUA satellite have been used advantageously to provide required information on aerosol layer height and aerosol type to reduce the uncertainty of OMI retrieved aerosol optical depth and single scattering albedo. CALIOP observations over a three-year period were used to develop a global climatology of aerosol layer height. A scheme to separate dust from smoke was also developed based on the combined use of OMI AAI and AIRS CO amounts. These two parameters were combined into an Aerosol Type Index that allows the clear identification of smoke from dust, and thus allows for a more accurate characterization of AOD and SSA. In this presentation we will discuss the combined use of observations from three A-train sensors into a single algorithm for aerosol absorption characterization. We will illustrate improvement in retrieval results by comparison to ground based observations.
219.	Mrs. Qing Z Trepte *SSAI*	A Comparison of Cloud Detection between CERES Ed4 Cloud Mask and CALIPSO Vertical Feature Mask	Poster	In climate and earth energy budget studies, understanding the presence and distribution of various clouds is a very important first step. CERES cloud mask is a global cloud detection algorithm using Terra and Aqua MODIS data as well as other ancillary data sets and it is used operational in NASA's Cloud and Earth's Radiant Energy System (CERES) project. Comparison between CERES Ed4 cloud mask and CALIPSO Vertical Feature Mask (VFM) provides a powerful tool to validate and improve CERES cloud detection globally as well as to understand the strength and limitation of cloud retrievals between active and passive satellite senses. In this paper, individual comparison cases will be presented for different types of clouds over various surfaces, including daytime and nighttime conditions and polar and non-polar regions. In addition, the statistics of the global cloud occurrence comparison between CERES Ed4 cloud mask and CALIPSO VFM will be discussed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
220.	Ms. Alexandra Tsekeri *City College of New York*	Potential retrieval of aerosol properties combining the Aerosol Polarimetry Sensor (APS) measurements with vertical structure information.	Poster	Quantifying aerosols and studying the atmospheric processes in which they take part is crucial for understanding the global climate. Aerosol retrievals usually involve only the intensity measurements of the scattered light. However, this approach has been proven quite limited for cases of absorbing aerosols and contamination from the ground surfaces. Furthermore, multiangle polarization measurements such as POLDER have been used but the lack of long wavelength channels make them less suited in separation of atmosphere and ground signals. With the above limitations in mind, we explore the possibility of retrieving the aerosol size distribution characteristics as well as the aerosol single scattering albedo (SSA) using the unique potential of the Aerosol Polarimetry Sensor (APS) on the GLORY satellite. In particular, using a Neural Network approach on the simplest case, the single scattering approximation, NN estimators of the size distribution characteristics and the complex refractive index (i.e SSA) are obtained with correlations > 0.9. As a future goal, we plan to compare the retrieval against conventional intensity measurements from MODIS to better illustrate the advantages of APS and to explore the potential improvement in the retrieval by ingesting the vertical structure obtained from simultaneous Calipso Lidar measurements.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
221.	Prof. Wen-wen Tung *Purdue University*	The impact of precipitating hydrometeors on the cloud-radiative forcing in the south Asian summer monsoon	Poster	A sensitivity test was performed to examine the impact of excluding precipitating hydrometeors for radiation calculations on atmospheric radiative fluxes and heating rates, as well as surface precipitation and dynamics, using the WRF-ARW model with 27-9-km nested domains for the entire August, 2006. The monthly mean results suggest that the exclusion of these components of atmospheric cloud mass could result in a minor shift of the monsoon trough and intensified convective systems; consequently, the associated surface shortwave flux differences were about 10-20 W/m2 and net longwave differences about 10-30 W/m2 at the TOA around the monsoon trough. These differences resulted in changes to the vertical structure of the longwave and shortwave radiative heating profiles. With deviations up to an order of 1 K/day of cooling in the mid to upper troposphere, a more unstable vertical column was resulted accompanied with enhanced updrafts and therefore greater production of surface precipitation and total water content in the troposphere. Composites of the MDs in the simulation confirmed these findings, and further indicated that the storm sizes might have increased as well. The implications from these results are that for conventional GCMs that exclude these precipitating components in their radiation calculations, TOA radiation balance may be achieved through compensating errors, which can introduce atmospheric circulation and precipitation biases.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
222.	Dr. Gerd-Jan van Zadelhoff *KNMI*	Validating aerosol retrieval algorithms for satellite lidar data using realistic model scenes.	Poster	Aerosols play a key role in the Earth radiation budget through direct radiative effects (extinction and reflection of solar and IR radiation) and indirect effects (impact on cloud formation and life time). In the atmospheric boundary layer they are a key component affecting air quality. The observation of aerosols and their radiative effects on a global scale can be studied using active remote sensing (lidar) data from space. Currently the data-set from the backscatter lidar (CALIOP) onboard the CALIPSO satellite is the only one available for this task. Future satellite mission like EarthCARE and possibly ACE will use High Spectral Resolution Lidar (HSRL) instruments, which will enable direct extinction retrievals from the measured signals in contrary to the CALIOP signals where a mean backscatter to extinction ratio is required, which is based on particle type and where possible constrained by the extinction retrieval itself. In both cases the retrieved extinction, effective radii or particle type needs to be validated before results from the retrieval algorithms can be trusted. In this work the construction of a number of model scenes and forward modeled lidar data is discussed for the testing and validation of lidar retrieval algorithms from space. Within the ESA sponsored ICAROHS study, there was a need for realistic model scenes for developing improved scientific algorithms for retrievals of aerosol optical properties and of tools for future multi-wavelength space borne HSRL instrument assessments. These are based on HSRL and in-situ measurements from the DLR aircraft from the SAMUM-1 and -2, EUCAARI and the LACE campaigns. These quality-controlled observational data feed into the existing EarthCARE simulator (ECSIM), which serves as the platform for algorithm development and verification but also for instrument design studies. The horizontal and vertical resolution within each of the scenes is based on the lidar dataset and aircraft velocity. The aerosol properties (particle size distribution, etc.) are assumed to be constant within the scene for each separate particle type and occasionally for different height regimes within one particle type, but scaled to match the local extinction. This is based on the available data from the in-situ measurements and can, due to the longer integration times needed to retrieve the in-situ properties, not be provided separately at each individual point. For each of the scenes the lidar signals were forward modeled within the EarthCARE simulator using a 3-D Monte Carlo code and include assumptions on the photon equivalent dark noise and the (quantum-) efficiencies of the optical elements within the lidar system. The calculations adopting the DLR-Falcon lidar configuration are subsequently compared to the original measurements, and show correlation factors of 0.96 and differences up to 4% between the original observations and forward modeled results for the SAMUM-1 cases. The results show that both the created scenes and forward modeled lidar signals (including the multiple scattering and scattering properties) are very realistic. The same lidar simulation can be used to either mimic realistic signals for future instruments from space (e.g. EarthCARE) or

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
223.	Dr. Tamas Varnai *University of Maryland Baltimore County*	Analysis of co-located CALIPSO and MODIS aerosol observations near clouds	Poster	Several recent studies have found that, due to processes such as aerosol swelling in humid air, clouds are surrounded by a transition zone of rapidly changing aerosol optical properties. Characterizing this transition zone is important for better understanding aerosol-cloud interactions and aerosol radiative effects, and also for improving satellite retrievals of aerosol properties. This study examines the transition zone by analyzing co-located MODIS and CALIPSO (lidar and imager) clear sky data in the vicinity of clouds. Combining data from various instruments allows us to take advantage of the active and passive instruments' capabilities and limitations complementing each other (e.g., vertical information but larger noise for a lidar, and spectral and cross-track information but complications due to 3D radiative processes for passive imagers). The poster presents a statistical analysis of the way CALIPSO and MODIS aerosol observations change near clouds, and of the way these changes depend on location and on aerosol and cloud properties. The findings can help better understand aerosol-cloud interactions and aerosol radiative effects, and can also help address a dilemma: While excluding the transition zone in order to avoid its remote sensing uncertainties can bias a study toward low aerosol optical depths and radiative effects, including passive instrument data on the transition zone despite the remote sensing uncertainties can bias the study toward too high aerosol optical depths and radiative effects.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
224.	Dr. Alexander P Vasilkov *Science Systems and Applications, Inc.*	A study of clouds and ozone over snow and ice using A-Train observations	Poster	We examine how clouds over snow and ice affect ozone absorption and how these effects may be accounted for in retrieval algorithms. Over snow and ice, the Aura/OMI Raman cloud pressure algorithm derives an effective scene pressure assuming a Lambertian surface. When this scene pressure differs appreciably from the climatological surface pressure, the difference is likely caused by a cloud of moderate to high optical thickness. We have used a pressure difference of 100 hPa as a crude threshold for the detection of clouds that provide significant shielding of tropospheric ozone absorption. The Auqa/MODIS CO2 slicing algorithm provides a good estimate of the cloud top pressure for high clouds. Using a combination of OMI and MODIS, we may therefore distinguish between optically thick and thin clouds over snow ice. To evaluate this approach, we have performed a number of radiative transfer simulations under various observing conditions. We find that the sensitivity of ozone absorption to clouds varies significantly with the viewing geometry as well as the surface albedo. We also evaluate our results using estimates of cloud vertical extinction profiles from CloudSat and MODIS. Currently, the OMI-TOMS total ozone algorithm assumes no clouds over snow and ice. This assumption can lead to an underestimate of the total column ozone over snow and ice when clouds are present because ozone beneath the clouds is not accounted for. Use of the OMI effective scene pressure reduces this type of error and results in a more homogeneous spatial distribution of the retrieved column ozone over snow and ice. We evaluate OMI-TOMS total column ozone retrievals over snow and ice using the OMI effective scene pressures.
225.	Mr. Abhishek Verma *Department of Atmospheric Sciences, Texas A&M University*	Assessment of clear-sky TOA fluxes from MERRA Reanalyses using CERES data products	Poster (Withdrawn)	Quantifying changes in top-of-atmosphere fluxes (TOA) is crucial for understanding recent trends in the global climate. NASA's CERES (Clouds and the Earth's Radiant Energy System) instruments are specifically designed to measure the earth's radiation budget (ERB) and have proven to be a valuable resource of TOA flux measurements. Recently, MERRA (Modern Era Retrospective-analysis for Research and Applications), which uses NASA's GEOS-5 Data Assimilation System, has started providing ERB data at very fine resolution in space and time. The aim of this study is to qualitatively assess the MERRA fluxes with fluxes derived from CERES data products. Comparisons of instantaneous clear-sky fluxes indicate regions of high biases, in reflected sunlight and emitted thermal radiations, over sea ice region and distinct land features. But despite the existence of biases, the anomalies in global flux distribution were found to be in good agreement on a monthly time scale.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
226.	Prof. Thomas H Vonder Haar *Colorado State University*	Studies of the Generation of Available Potential Energy (GAPE) Using A-Train Observations	Poster	Zonal and Eddy GAPE will be estimated from multiple years of estimates of profiles of diabatic heating/cooling using CloudSat/Calipso/Aqua Observations. Results will allow study of large and medium scale atmospheric energetic as well as comparison with concurrent GCM results. Our objectives are to develop new information on the annual cycles of energetic from global to “storm” scale in both hemispheres. This new research project will be outlined for discussions and interaction.
227.	Dr. Duane Waliser *Jet Propulsion Laboratory/Caltech*	The Impact of Precipitating Ice and Snow on the Radiation Balance in Global Climate Models	Talk	Climate models often ignore the radiative impact of precipitating hydrometeors (e.g., rain, snow) due in part to the perception that the combination of their limited spatial and temporal extent and large particle radii are insufficient to have a tangible radiative impact on the atmosphere and because there has been limited observations on the amount of precipitating hydrometeor mass in the atmosphere. CloudSat retrievals of ice water content provide one of the first comprehensive means to estimate the amount of precipitating ice mass in the atmosphere and characterize its vertical structure. With this information, atmospheric radiative transfer calculations are performed to examine the impact of excluding ice associated with precipitating hydrometeors on atmospheric radiative fluxes and heating rates. The results show that exclusion of precipitating ice can result in underestimates of the surface shortwave by 5-10 Wm-2 in the most convective and rainfall intensive areas. Similar errors are found at the top of the atmosphere (TOA) with underestimates of the reflected shortwave and overestimates of the emitted longwave. There are considerable differences (up to ~25%) in the vertical distribution of radiative heating (O[0.1 K day-1]) with about a 10% overestimation of the integrated column cooling. The implications of these results are that models that exclude these ice components in their radiation calculations are achieving TOA radiation balance through compensating errors as well as introducing biases in atmospheric circulations.
228.	Dr. Jun Wang *Univ. of Nebraska - Lincoln*	Do we have more fires in hot days?	Poster	MODIS fire product, aerosol product, and land surface temperature are combined to analyze the following questions: (i) do we see more number of fires in days with higher temperature? (ii) can we see the land surface temperature change in high aerosol optical thickness condition? (iii) should the increase of land surface temperature due to heat release from the fires be considered in the evaluation of regional temperature change? Examples of our analysis over the central America will be shown.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
229.	Dr. Jun Wang *Univ. of Nebraska - Lincoln*	Sub-Pixel Fractional Area of Wildfires from MODIS Observations: Retrieval, Validation, and Potential Applications	Poster	Detailed validations of retrieved fire area fractions are now possible in the western United States via the multispectral, high-resolution data (3-50 meters) obtained from the Autonomous Modular Sensor (AMS), flown aboard an Unmanned Airborne Vehicle (UAV). Using this validation tool, the potential for obtaining sub-pixel fire (hot spot) information for fire pixels detected by the MODerate Resolution Imaging Spectroradiometer (MODIS) is investigated. A two-component model (Dozier method) for retrieving sub-pixel fire area fraction and temperature has been available since 1981. However, modifications are made to the retrieval to account for atmospheric effects by implementing output from a radiative transfer model at 3.96 and 11 μm (MODIS fire detection channels). Using several fire events in the Western United states, a comparison between the retrieved fire fractions for MODIS and the AMS flight scans is preformed. Specific results from a large fire event in southern California suggest that the retrieval may be possible for fires covering a fractional area greater than 0.003 (corresponds to a 3000 m2 fire within a MODIS' nadir pixel). In addition, a clustering technique is implemented to remove potential sources of error that exist when using individual pixels. Slight deviations between MODIS and AMS background temperature are found to dramatically affect the retrieved fire area fraction. This sub-pixel retrieval will have several potentially important applications. It will not only provide a valuable step for improving emissions estimates and plume height forecasts, but also allow the meteorological effects on fire intensity (e.g., fire radiative power normalized to the fire size instead of pixel area) to be investigated. From an operational perspective, this may prove critical for determining the size of a fire front, spread rate, and more accurate fire radiative power (FRP) data.
230.	Mr. Tao Wang *Texas A&M University*	Identification of convective cirrus clouds in the TTL	Poster	Two mechanisms appear to be primarily responsible for the formation of cirrus clouds in the Tropical Tropopause Layer (TTL): detrainment from convection and in situ formation. In this poster, we use measurements of ice water content (IWC) to identify TTL cirrus clouds that contain too much water to have formed in situ — and therefore must be of convective origin. This paper gives a demonstration of how those convectively originated cirrus clouds are identified and where they are distributed seasonally in 2009 by using Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) level 2 cloud profile data with version 3 release. The identification suggests that as many as 37% of cirrus clouds are of convective origin in boreal winter at about 375 K (~17 km, approximately the cold point tropopause) when averaging over the entire tropics. In boreal summer, at this level there will be as many as 41% that are of convective origin.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
231.	Prof. Zhien Wang *University of Wyoming*	A global view of mixed-phase cloud distribution and ice generation in them with A-train satellite measurements	Poster	Mixed-phase clouds play an important role in the climate system, but are still poorly understood and simulated. CloudSat and CALIPSO measurements provide the first opportunity to accurately determine the mixed-phase cloud global distribution and new potentials to better characterize their properties. By combining lidar's high sensitivity to high concentration small water droplets and radar's high sensitivity to low concentration large ice particles, an algorithm is developed to reliably identify mixed-phase clouds based on CloudSat and CALIPSO measurements. For the first time, we are able to provide a global view of mixed-phase cloud distribution and their seasonal variations. Annual mean global mixed-phase cloud occurrence is ~15.3%, but regional mixed-phase cloud occurrence could as high as 60%. Mixed-phase cloud geographical and vertical distributions will be discussed in details. By combining CloudSat and CALIPSO observations, we will also show a new global picture of ice generation in stratiform mixed-phase ice clouds. Although, there are significant dependencies of ice generation on latitudes, the general signature of temperature impacts on ice generation is consistent globally. Two distinct ice formation zones in terms of cloud top temperature (CTT), colder or warmer than -18 °C, can be identified from the observations. The contrast of ice generation in these two temperature zones indicates different dominated ice generation mechanisms among them. The impact of aerosols on ice generation in these mixed-phase clouds will also be discussed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
232.	Dr. Fabien Waquet *Laboratoire d'Optique Atmosphérique, Université de Lille1*	Aerosols remote sensing over clouds using the A-train observations.	Poster	Biomass-burning particles can be injected high in the atmosphere and transported over clouds. Other aerosols as for instance mineral dust particles are also often observed above clouds. Recent studies shown that the presence of aerosol above clouds affects the retrieval of the cloud properties and the estimate of the aerosol indirect effect. Moreover, strong absorbing particles, as biomass burning ones, may reduce the amount of light reflected by the clouds back into space, causing an aerosol direct radiative forcing that is positive. This process contributes to global warming and remains not well understood. The detection of aerosol above clouds is then critical for both the estimate of the aerosols and clouds radiative impacts. We recently developed a method that allows retrieving aerosol properties over clouds that is based on the A-train observations. We shown that the comparison between the cloud top heights retrieved with the different passive techniques developed for the A-Train sensors can be used to detect the presence of aerosols above clouds. Aerosols also affect the polarized radiation reflected by the clouds. An approximate model of the signal measured by the POlarization and Directionality of Earth Reflectances (POLDER) instrument was developed. The proposed algorithm allows retrieving the aerosol optical thickness and a parameter indicative of the particles size. We will present and analyze results obtained with this method for various regions and situations. We will focus on the aerosol properties retrieved above clouds for the tropical southeast Atlantic region during the summer-time period (June – September, when biomass fires occur in Southern Africa). We will also consider other regions of the world where biomass burning particles and natural particles (e.g. dust and volcanic aerosols) are potentially transported above clouds. Finally, we will discuss the advantages and limitations of the proposed method using other tools that allow an exact modelling of the polarized signal. The final aim of this work is the characterization of the properties of aerosols located above clouds and the estimate the associated radiative forcing at a global scale.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
233.	Dr. Eric M Wilcox *Desert Research Institute*	Confirming the effects of African dust and smoke on clouds and climate using combined data from A-Train and other EOS sensors	Poster	Atmospheric modeling studies suggest that the presence of dust and smoke in the atmosphere above Africa alters the thermal structure of the troposphere with consequences for circulation patterns from the cloud scale to the synoptic scale. Combining multi-year remote sensing observations of aerosol loading, cloud properties, and precipitation from A-Train and other NASA Earth Observing System sensors has revealed empirical evidence in support of hypothesized effects of aerosols on clouds and climate derived from controlled experiments with the atmospheric models. Evidence in support of two such hypotheses is presented here. Saharan dust outbreaks coincide with a lower-tropospheric heating signature north of the tropical Atlantic Ocean intertropical convergence zone (ITCZ) attributable to advection of the Saharan Air Layer and absorption of solar radiation. The enhanced lower-tropospheric meridional temperature gradient draws rainfall along the ITCZ northward. This occurs in spite of a reduction of sea surface temperature north of the ITCZ attributable to enhanced solar scattering by dust particles. Further south, smoke from seasonal burning of the African Savannah is transported over a persistent deck of subtropical stratocumulus clouds over the Southeast Atlantic Ocean. The cloud layer thickens in response to heating above the cloud attributable to the strongly absorbing smoke aerosol. Heating by smoke at the 700 hPa level inhibits cloud-top entrainment, preserving humidity and cloud water in the boundary layer and leading to thickening and subsidence of the cloud layer. Empirical evidence derived from NASA A-Train observations in support of these hypotheses will be presented.
234.	Mr. David Winker *NASA LaRC*	Aspects of quality control in the development of CALIOP aerosol and cloud climatologies	Poster	Now that over four years of data have been acquired, the CALIPSO team is developing aerosol and cloud climatologies from this unique dataset of global profiles. A global gridded dataset of cloud occurrence has been developed for the GEWEX Cloud Assessment project now underway, and formal Level 3 aerosol and cloud products aimed at the general user community are now in development. In addition to describing mean aerosol and cloud properties, these Level 3 products will be simpler and easier to use than the current Level 2 products. Development of time-averaged gridded data products introduces additional demands on quality control, however. There are also issues of representivity due to the sparse sampling from nadir-only measurements, which drive the resolution of the grid on which data is reported. This presentation will discuss quality control and other issues related to development of Level 3 products from CALIOP.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
235.	Dr. Sun Wong *Jet Propulsion Laboratory, California Institute of Technology*	Understanding Global Hydrological and Thermodynamical Processes Using Water Vapor and Temperature Retrievals from Atmospheric Infrared Sounder (AIRS)	Poster	The apparent water vapor sinks and heat sources in the atmosphere are calculated as residuals in the water vapor and temperature budgets using the specific humidity and temperature retrievals from the Atmospheric Infrared Sounder/Advanced Microwave Sounding Unit (AIRS) and the assimilated wind fields from the NASA/GSFC Modern Era Retrospective-analysis for Research and Applications (MERRA). They are then used to understand the variability of the global hydrological processes. In particular, we use the intra-seasonal oscillation (ISO) of Indian summer monsoon as a test-bed to evaluate the AIRS/MERRA-derived water vapor sinks. The column integrated apparent water vapor sinks matches the ISO-related northward movement of precipitation anomaly observed by the Tropical Rainfall Measuring Mission (TRMM). Consistency between the temporal variations of the apparent heat source anomalies and the latent heat anomalies calculated from the TRMM Spectral Latent Heat algorithm indicates that the ISO in the apparent heat source is dominated by the variation in latent heat exchange. The mechanism behind the northward propagation is then analyzed by mapping water vapor and heat budget composites for the various phases of the ISO.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
236.	Norman Wood *Colorado State University*	Toward CloudSat 2C-SNOW: Microphysical constraints from intensive surface observations	Poster	The CloudSat CPR is sensitive to scattering by snow particles, but the relationship between snowfall rate and Ze is considerably variable. Representations of microphysical properties are needed to act as explicit a priori constraints on the 2C-SNOW retrieval and to model particle scattering and fallspeed. Toward that end, a microphysical property retrieval algorithm has been developed for application to intensive, surface-based observations of snowfall. This retrieval utilizes nearly-colocated observations of radar reflectivity, snowfall rate, size distribution and fallspeed, and produces estimates of the microphysical state. The state is represented by power law expressions giving particle mass and horizontally projected area as functions of particle size. The retrieval has been applied to four snowfall events from NH winter 2006-2007 which were observed during the Canadian CloudSat/CALIPSO Validation Project. The events consisted of both lake effect and synoptic snowfall. The retrieval was operated at moderately high time resolution in an attempt to capture the temporal variations in the microphysical properties. Although significant uncertainties remain in the retrieved states, some microphysical differences between events are discernable. The results additionally provide information about the multidimensional probability distribution of the state variables. These results will be utilized for evaluating the uncertainty characteristics of the 2C-SNOW algorithm forward model and for constraining the 2C-SNOW retrieval.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
237.	Prof. Robert Wood *University of Washington*	Control of cloud droplet concentration in marine stratocumulus clouds	Talk	Sensitivity studies with climate models demonstrate that the magnitude of the aerosol indirect effects depends strongly upon the minimum cloud droplet concentration (Nd) permitted in the model. These minima are generally artificially imposed to circumvent difficulties predicting the "background" cloud condensation nuclei (CCN) properties in the marine boundary layer (MBL) over the remote oceans. In general, the cloud droplet concentration over the remote oceans is poorly known and factors controlling it are poorly understood. Here I will present observations from a number of A-Train instruments including MODIS, CloudSat, AMSR-E, and from COSMIC spaceborne GPS radio occultation, to quantify and begin to understand the factors controlling the distribution of cloud droplet concentration for stratocumulus clouds over the oceans. Specifically, MODIS will be used to document the geographic and seasonal variability of Nd. A simple steady-state source-sink model is introduced to investigate factors controlling Nd, and a combination of CloudSat and AMSR-E data are used to attempt to quantify the contributions to Nd from (i) entrainment of aerosols from the free troposphere; (ii) surface wind-generated sea-salt; (iii) dry deposition; (iv) coalescence scavenging. We find that in the remote marine boundary layer a significant part of the geographic variability in Nd can be explained by the geographical variability in light precipitation. Since the light precipitation that helps to control Nd is itself sensitive to Nd, this potentially leads to strong feedbacks on Nd in regions where anthropogenic pollutants artificially increase the available CCN.
238.	Dr. Dong L Wu *Jet Propulsion Laboratory*	Upper-tropospheric ice water contents from A-Train MLS, CALIOP, and CloudSat	Poster	An empirical relation has been obtained between the 532-nm backscatter coefficient β532 and ice water content (IWC), , for small IWC values (0.5-5 mg/m3) using collocated A-Train MLS (Microwave Limb Sounder) and CALIOP (Cloud-Aerosol LIdar with Orthogonal Polarization) data at ~15 km. Because accuracy of satellite IWC measurements depends critically on microphysics assumptions used in the retrievals, this relationship provides a key constraint on microphysical properties of cirrus ice in the tropical tropopause layer (TTL) that requires consistency between microwave and lidar measurements. The MLS/CALIOP derived relationship is ~50% higher than that in CALIOP version 3.01 retrieval for the small IWC values. The normalized probability density function (PDF) of this IWC retrieval compares well with the statistics of in-situ measurements at 12 km. The IWC retrievals from the MLS, CALIOP and CloudSat suggest that the TTL has more water in the form of vapor than in cloud ice, although the total mass of cloud ice plus precipitating ice might exceed the vapor mass at these altitudes.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
239.	Yu Xie *Texas A&M University*	Determination of ice cloud models using MISR and MODIS measurements	Poster	Representation of ice clouds in radiative transfer simulations is subject to uncertainties associated with the shapes and sizes of ice crystals within cirrus clouds. In this study, we examined a number of ice cloud models consisting of smooth, roughened, homogeneous and inhomogeneous hexagonal ice crystals with various of aspect ratios. The sensitivity of the bulk scattering properties and solar reflectances by cirrus clouds to these ice cloud models is investigated using the Improved Geometric Optics Method (IGOM) and Discrete Ordinates Radiative Transfer (DISORT) model. An algorithm is developed to determine an appropriate ice cloud model for application to satellite-based retrieval of ice cloud properties. Collocated Moderate Resolution Imaging Spectroradiometer (MODIS) and Multi-angle Imaging SpectroRadiometer (MISR) data are used to retrieve the optical thicknesses of ice clouds as a function of scattering angle in the nine MISR viewing directions. The difference between cloud optical thickness and its averaged value over the nine viewing angles can be used to validate the ice cloud models. Using the data obtained on July 2, 2009, an appropriate ice cloud model is determined. With the presence of all the uncertainties in the current operational satellite-based retrievals of ice cloud properties, this ice cloud model has excellent performance in terms of consistency in cloud property retrievals with the nine MISR viewing angles.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
240.	Prof. Ping Yang *Texas A&M University*	Study of ice cloud properties from synergetic use of satellite observations/products and modeling capabilities	Poster	We report two ongoing efforts studying ice cloud properties from synergetic use of MODIS products/measurements, CALIPSO measurement, MERRA reanalysis data and radiative transfer (RT) modeling capabilities. In the first effort, a fast infrared RT model is employed to retrieve ice cloud optical thickness and effective particle size. Cloud properties are optimally selected to match the RT simulations with the TOA radiances observed by MODIS at bands 29, 31, 32 centered at 8.5 μm, 11.0 μm and 12.0 μm, respectively . In the forward RT simulations, CALIPSO product is utilized to specify cloud height and MERRA data are used as inputs for atmospheric profiles. The advantage of this approach is its applicability to both daytime and nighttime conditions. For daytime retrieval, it is found that ice cloud optical thickness values inferred from the MODIS infrared channels are systematically smaller than the operational products based on visible and near-infrared channels. To improve our understanding of the climatology of high cloud properties, in the second effort we have been analyzing more than six years of Aqua MODIS cloud product developed by the NASA Goddard Space Flight center (hereafter GSFC-MODIS) and one single year (2008) data of the MODIS product developed by the NASA Langley Research center, (hereafter LaRC-MODIS). The analysis is carried out for geographical region between 60°N to 60°. The seasonal variations and geographical distributions of ice cloud properties are analyzed in detail. Furthermore, we have been studying the statistical relationships between cloud fraction and other properties using GSFC-MODIS monthly data.
241.	Mr. Bingqi Yi *Texas A&M University*	Global Aerosol Climatology from the MODIS Instrument and Model simulations	Poster	Numerous satellite measurements have been used to retrieve the aerosol properties. But, quantitative differences between various satellite-based aerosol climatologies are significant. With the new Deep Blue algorithm aerosol product available in the latest release collection of MODIS data, we are able to obtain the aerosol information over bright surfaces such as deserts. The Deep Blue algorithm employs the radiances from the blue channels of the MODIS instrument and extends the derivation of aerosol optical depth over land to bright surfaces at 0.412, 0.49 and 0.67 μm channels. In this study, aerosol climatology is surveyed based on the synergy of the Deep Blue aerosol products and the MODIS dark target algorithm counterparts for 12 regions over land. Furthermore, using the NCAR Community Atmospheric Model (CAM) forced by observed historical sea surface temperature, the dust aerosol optical depths over bright surface desert regions are simulated. The annual variation and seasonal cycle of dust optical depth from the simulations are similar to the observed counterparts. However, it is found that the model simulations tend to overestimate the global dust loading.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
242.	Dr. Stuart A Young *CSIRO Marine & Atmospheric Research*	Lidar Ratios for Dust Aerosols Derived from Retrievals of CALIPSO Visible Extinction Profiles Constrained by Optical Depths from MODIS-Aqua and CALIPSO/CloudSat Ocean Surface Reflectance Measurements.	Poster	CALIPSO's (Cloud Aerosol Lidar Infrared Pathfinder Satellite Observations) global optical depth and aerosol extinction profile data products are finding widespread use in studies and modelling of air quality and global climate change. However, CALIPSO's analysis algorithms generally require the use of tabulated values of the lidar ratio for each aerosol type in order to retrieve the extinction and optical depth from the measured profiles of attenuated backscatter. It is known that, for any given time or location, the lidar ratio for a given aerosol type can differ from the tabulated value. To gain some insight as to the extent of the variability with respect to the tabulated values, we report here on calculations of the lidar ratio for dust aerosols using constrained retrievals of CALIPSO extinction profiles. CALIPSO extinction profiles are constrained using column optical depth measurements from two sources. Firstly, daytime measurements are constrained using Level 2, Collection 5, 550-nm aerosol optical depth measurements made over the ocean by the MODIS (Moderate Resolution Imaging Spectroradiometer) on board the Aqua satellite, which flies in formation with CALIPSO and CloudSat as part of the A-Train constellation of satellites. In order to reduce the influence of potential errors in the calibration of CALIPSO's attenuated backscatter profiles, which can be less accurate during the day because of the lower SNR and the consequent difficulty in calibration against a molecular reference, we also retrieve lidar ratios from night time profiles. Here the aerosol column optical depth is obtained by analysis of CALIPSO and CloudSat backscatter signals from the ocean surface. (The method also provides a check on CALIPSO's calibration when used in regions of negligible aerosol column optical depth or where this quantity is known from independent measurements.) Results obtained over a number of days from different measurement locations are compared with CALIPSO's standard values.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
243.	Dr. Hongbin Yu *University of Maryland*	An integrated analysis of aerosols above clouds from A-Train measurements: empirical relationships between CALIOP above-cloud AOD and OMI UV absorbing aerosol index	Poster	Aerosols above clouds are essential to understanding the climate forcing and intercontinental transport of aerosols. Large diversities exist currently in model simulations of above-cloud aerosols. While satellite remote sensing of aerosols is often performed in cloud free scenes, there is some capability of detecting aerosol above clouds from satellites. CALIOP on CALIPSO can measure aerosol backscatter and extinction profiles above clouds, but only with limited coverage. OMI on Aura can detect UV-absorbing dust and smoke above clouds by means of the UV absorbing aerosol index (AI), a semi-quantitative measure of aerosol loading that also depends strongly on the reflectance of underlying clouds. Multiple scattering from underlying clouds enhances the aerosol absorption, resulting in a more positive AI than that in cloud free conditions. The major advantage of OMI over CALIOP measurements is OMI's wide swath and nearly daily global coverage. It is interesting to explore the possibility of deriving above-cloud AOD with nearly daily global coverage based on an integrated analysis of OMI and CALIOP measurements. In this study, we will show some preliminary results from a statistical analysis of collocated CALIOP above-cloud AOD and OMI AI covering June-September of 2006 and 2007 for smoke over South Atlantic and for dust over North Atlantic, respectively. Statistically above-cloud AOD decreases with increasing cloud optical depth for a given value of AI, with the relationship depending on aerosol type. Further studies, including a suite of radiative transfer modeling, are needed to explore the feasibility of empirically deriving global daily above-cloud AOD from OMI UV absorbing aerosol index.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
244.	Dr. Hongbin Yu *University of Maryland*	Climatology of trans-Atlantic dust transport derived from multiple A-Train measurements and a global model	Poster	Trans-Atlantic dust transport has important implications for weather, climate, air quality, and biogeochemistry. In this study we derive five-year (2003-2007) climatology of trans-Atlantic dust transport from multiple A-Train measurements and GOCART model. Dust aerosol optical depths (AOD) are derived from (a) MODIS total AOD and fine-mode fraction, (b) MISR total AOD and non-spherical fraction, and (c) AIRS thermal infrared retrieval of AOD. Centroid heights of dust layer from AIRS and CALIOP are also examined. We compared the satellite measurements and model simulations by accounting for different sensitivities of individual measurements. In general, while the model compares quite well with satellite measurements off the coast of South Africa, the modeled dust AOD becomes substantially smaller than satellite measurements, with the difference increases with increasing distance from the coast. In Caribbean Sea, the difference can be more than a factor of 2. This suggests that removal processes in the model may be too intense. The model simulations of dust centroid heights are lower than AIRS but higher than CALIOP measurements. Two-year CALIOP measurements in the peak dust season also suggest that about 30% of dust transport occurred above clouds, most frequently at 3-3.4 km. The seasonal and regional averaged above-cloud AOD is 0.292±0.223, which is about 25% lower than 0.432±0.328 that is averaged in cloud-free conditions for aerosol centroid height greater than 1.6 km, the lowest centroid height for the detected dust layers above clouds.
245.	Dr. Tianle Yuan *NASA GSFC/ UMBC JCET*	What does nature tell us about aerosol indirect effects on trade cumulus?	Poster	Increased aerosol concentrations can raise planetary albedo not only by reflecting sunlight and increasing cloud albedo, but also by changing cloud coverage or lifetime, which has been illusive to observational detection and modeling due to various buffering mechanisms and convolution of meteorology. Here, through a natural experiment we observationally demonstrate aerosol effect on cloud coverage. The A-Train satellite data reveal large-scale 'volcano tracks' of reduced droplet size, decreased precipitation efficiency, enhanced cloud fraction and increased cloud top height associated with low-lying volcanic sulfate plumes. The aerosol-precipitation-cloud interactions create total aerosol forcing of -20Wm-2 and reduce latent heat transfer by 8Wm-2 over more than 1x106 km2. Our results provide observational constraints for climate models to reduce uncertainties associated with aerosol-cloud interactions.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
246.	Qing Yue *Jet Propulsion Laboratory*	Relationship between oceanic boundary layer clouds and lower tropospheric stability observed by AIRS, CloudSat and CALIOP	Poster	Thirteen months of matched temperature and water vapor profiles from the Atmospheric Infrared Sounder (AIRS), and cloud profiles from the CloudSat and Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instruments, are used to quantify aspects of maritime boundary layer clouds and their thermodynamic environment. The AIRS retrieval yield over the oceans between 40°S and 40°N within CloudSat identified Sc clouds is between 61% and 71% globally, and is greater than 80–90% throughout most of the subtropics. The lower tropospheric stability (LTS) and estimated inversion strength (EIS) are derived from AIRS temperature and water vapor profiles. Temperature inversions are detected about 2–6% of the time, while positive values of EIS occur about 68.5% of the time within scenes identified as Stratocumulus by CloudSat. The relative magnitudes and seasonality of LTS and EIS in the subtropical stratocumulus regions are very similar to reanalysis and surface cloud observations, but differences are found in the mid-latitude regions with low AIRS yield. Low cloud fraction obtained from AIRS, the radar, and a combination of the radar+lidar is somewhat more correlated with EIS than with LTS. Furthermore, correlations improve with cloud fraction from the radar+lidar compared to the radar-only version, demonstrating the importance of CALIOP to detect shallow low clouds over the oceans. This multi-sensor investigation establishes a basis for using A-train observations to quantify low cloud-climate feedback.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
247.	SHAN ZENG *Laboratoire d' Optique Atmosphérique*	Intercomparison of cloud thermodynamic phase from passive and active sensors in the A-Train constellation	Poster	The A-Train observations provide an unprecedented opportunity for the production of high quality dataset describing cloud cover properties. We illustrate in this study that the 1 year of coincident POLDER (Polarization and Directionality of the Earth Reflectance), MODIS (MODerate Resolution Imaging Spectroradiometer) and CALIOP (Cloud-Aerosol Lidar with Orthogonal Polarization) observations enable in particular the establishment of a reference dataset for the description of cloud top thermodynamic phase at global scale. We will present the results of extensive comparisons between POLDER and MODIS cloud top phase products and discuss those in view of cloud vertical structure and optical properties derived simultaneously from collocated CALIOP active observations. These results allow to identify and quantify potential biases present in the 3 considered dataset. Among those, we will discuss the impact of thin cirrus, aerosols, snow/ice surfaces, multilayer and fractional cloud cover on global statistics of cloud phase derived from POLDER and MODIS passive measurements. It will also be shown that the different methods used to derive phase information present systematic differences correlated to observation geometries. Based on theses analysis we define criteria for the selection of high confidence cloud phase retrievals which in turn serve for the establishment of a reference cloud phase product. This high confidence joint product has been derived for the 5 years of POLDER/Parasol and MODIS/Aqua coincident observational period. We will briefly illustrate how it can be used as a benchmark for the evaluation of other cloud climatologies, for the assessment of cloud phase representation in models and the development of better cloud phase parametrization in GCMs.
248.	Dr. Pengwang Zhai *SSAI*	Decoupling error for the atmospheric correction in ocean color remote sensing algorithms	Poster	The atmospheric correction procedures in the ocean color remote sensing algorithms generally ignore the multiple scattering between the atmospheric and ocean components, i.e., the atmosphere and ocean are decoupled. In this presentation, we study the decoupling error originated from this non-physical assumption using a vector radiative transfer model for the Coupled Atmosphere and Ocean (CAO) system. The updated bio-optical models for the inherent optical properties (IOPs) of the ocean are used for this study. We focus on two wavelengths, 412 nm and 555 nm in the study. The decoupling error depends on the detector locations. For a detector located just above the ocean interface decoupling error ranges from 0.3% to 7% for zenith viewing angles smaller than 70°. For other locations, it is hard to separate the decoupling error from the error introduced by the diffuse transmittance. However, the diffuse transmittance can be estimated if assuming the upwelling radiance is uniform just below the ocean surface. Under this condition, the decoupling error is from -4% to 8% for zenith viewing angles smaller than 70° at the top of the atmosphere. Also negative decoupling error shows up at mainly large zenith viewing angles.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
249.	Dr. Pengwang Zhai *SSAI*	Oil spill detection with combined lidar and polarimetry measurements	Poster	The Deepwater Horizon oil spill in 2010 has caused extensive detrimental consequences on both the natural and social environments. During May and July of 2010 NASA Langley B-200 aircraft has been deployed to fly over the oil spill site in the efforts to detect and evaluate the range of the oil spill as well as to collect data for developing algorithms in atmospheric and oceanic remote sensing. Some flight segments were spatially and temporally co-located with CALIPSO overpasses. Two scientific instruments have been mounted on the aircraft, which are the NASA Langley High Spectral Resolution Lidar (HSRL) [Hair et al., Appl. Opt. 47, 6734-6752, (2008)] and the Research Scanning Polarimetry (RSP) [Cairns et al., Proc. SPIE 3754, 186-196 (1999)]. The HSRL is used to characterize both aerosols/clouds and surface roughness [Hu et al., Atmos. Chem. Phys., 8, 3593-3601 (2008)]. Particularly, lidar signal is inversely proportional to surface mean slope and mean square slope of oil surface is much smaller than water surface. In addition, Fresnel reflection coefficient for the oil surface is twice as large as that of the water surface at 532 nm. As a consequence, lidar signal from the oil surface at nadir view is much brighter than water surface. The RSP instrument is a unique tool to reduce the uncertainty of aerosol property retrieval [Chowdhary et al., Geophys. Res. Lett., 28, 243-246, (2001).]. In this study, we focus on the surface roughness determined from the glint pattern at the 2250 nm RSP band using the Cox/Munk model. The essence is that very low aerosol radiance contributions at this wavelength. Moreover, index of refraction information can be obtained from the polarization measurement at the same wavelength. Oil surface detections from the HSRL and RSP instruments agree reasonably well with NOAA's ocean surface oil data. We will also show ocean subsurface signatures using the same combined lidar/polarimetry measurements. Ultimately, the analysis of these data will help show the degree to which CALIPSO and Glory data can be used to detect and perhaps quantify oil from oil spills at/near the water surface.
250.	Dr. Qiuqing Zhang *University of Utah*	Description of Cloud Occurrence from CloudSat-CALIPSO Cloud Mask Data and Comparison of the Measured Cloud Fraction with GCM Simulations	Poster	The CloudSat 2B-Geoprof-Lidar product merges the millimeter radar data collected by Cloudsat with the lidar data collected by CALIPSO, and provides a unique description of the vertical and horizontal structure of hydrometeor layers. Using four years of 2B-Geoprof-Lidar data (July 2006 to June 2010), we investigate the vertical and horizontal distribution of cloud occurrence and compare the cloud occurrence fraction measured by CloudSat-CALIPSO with GCMs model results from the Cloud Feedback Model Intercomparison Project (CFMIP) project.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
251.	Dr. Yan Zhang *NASA GSFC*	Intercomparisons of aerosol optical depth from ground-based networks, MODIS retrievals and GOCART simulations over China	Poster	China is one of the largest emitters of particles and precursor gases in the world. However, the characterization of aerosols over China has remained very uncertain because of lack of measurements. In recent years, some aerosol networks have been established in China, including AERONET and the China Aerosol Remote Sensing NETwork (CARSNET). Our comparison of CARSNET data with AERONET data from 2005 to 2008 in Beijing shows that the two datasets agree quite well. These emerging measurements provide an unprecedented opportunity of evaluating satellite retrievals and model simulations. We used 2005-2007 aerosol measurements from 12 CARSNET sites and 6 AERONET sites covering large geographical areas of China to evaluate MODIS Dark Target (DT) and Deep Blue (DB) retrievals and GOCART simulations. The MODIS DT AODs are on average lower than the CARSNET and AERONET measurements by about 30% over forest and rural areas, but can be higher by 30-100% over urban and sparsely vegetated areas. The MODIS DB AODs agree with the measurements better than the MODIS DT AODs only over the sparsely vegetated areas. In general, the GOCART model simulations well capture the observed seasonal variations of AOD and Angstrom exponent, but are lower than the ground-based AOD measurements by a factor of 2. Efforts are being made to improve the model simulations using newly developed emission inventories.
252.	Dr. Yuying Zhang *PCMDI, LLNL*	Variations in Arctic cloud patterns, vertical structure and cloud radiative forcing	Poster	In this study, we use satellite observations to understand the recent seasonal and annual variations in Arctic clouds and their radiative effect. The major observations shown here are from CloudSat and CALIPSO. Because using the new active sensing measurements to detect clouds does not rely on the vertically-integrated emission and scattering of the atmosphere and surface, these data are particularly valuable in polar regions. To extend the study, traditional data from ISCCP (or MODIS) with better spatial sampling are used. Additionally, ground-based data from ARM NSA and Eureka Canada sites will be another good complement for future study. This work was performed under the auspices of the U. S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
253.	Dr. Zhibo Zhang *GEST/UMBC/GSFC/NASA*	On the consistency between cloud particle effective radius retrievals for marine water clouds based on three shortwave infrared bands of MODIS: Observations and Theoretical considerations	Poster	The Moderate Resolution Imaging Spectroradiometer (MODIS) cloud property products provide three independent sets of cloud particle effective radius (re) retrievals based on the 1.6μm, 2.1μm and 3.7μm band observations, respectively. In this study the differences among the three MODIS re retrievals (i.e., re(1.6μm) re(2.1μm) and re(3.7μm)) for maritime water clouds were systematically investigated and documented through a series of case studies based on the MODIS level-2 product and global analyses based on the level-3 data. It was found that the three re retrievals agree reasonably well (within about) with each other over the closed-cell cloud regions. However, the differences among the three re retrievals increase substantially over the broken cloud regions, with the re(3.7μm) retrieval often found to be smaller than the operational re(2.1μm) retrieval by more than 10μm. A further correlation study revealed two important features of the differences among the three re retrievals. The first is that generally the difference between re(3.7μm) and re(2.1μm) remains relatively small and stable when re(2.1μm) is smaller than about 15μm, but grows rapidly with increasing re(2.1μm) once re(2.1μm) exceeds 15μm. The other important feature is that the correlation between sub-pixel cloud horizontal behavior and the re(1.6μm) (and the re(2.1μm) as well) exhibits a threshold-like behavior. The pattern of the probability density function (PDF) of both re(1.6μm) and re(2.1μm) remains relatively stable for small sub-pixel cloud horizontal inhomogeneity ( ), but shifts rapidly to larger values after exceeds certain value. In contrast, the shape of the PDF of re(3.7μm) shows no obvious dependence on . Based on the observational studies, two hypotheses were proposed to explain the large difference between re(3.7μm) and re(2.1μm) and the observed dependence of the difference on re and . The first hypothesis is forwarded regarding the vertical structure of marine water clouds as a result of the warm rain processes and the different penetration depths of the 1.6μm, 2.1μm and 3.7μm bands. The second hypothesis involves the coupling of the cloud horizontal inhomogeneity, 3-D radiative effects and the artifact in re retrieval due to the nonlinearity of the look-up-table. Finally, directions for future research and the implications of the results are discussed.

A-Train 2010 Abstract Submissions

Category: aerosols, clouds, hydrological cycle, and radiation

	Name	Abstract Title	Accepted Abstract Format	Abstract
254.	Li Zhu *UMBC*	Measuring Aerosol Spectral Absorption over Land with MODIS	Poster	Atmospheric aerosols absorb solar radiation and directly affect the Earth's energy budget. This effect disturbs the atmospheric temperature profile, which can influence cloud formation, cloud lifetime, and precipitation. This research uses the critical reflectance technique, a space-based remote sensing method, to measure the spatial distribution aerosol absorption properties over land. A series of sensitivity studies were undertaken to analyze the potential limitations of this method and show that the retrieved results are relatively insensitive to uncertainties in the aerosol models that are used as input parameters. The critical reflectance technique is then applied to Moderate Resolution Imaging Spectrometer (MODIS) data to retrieve the spectral aerosol single scattering albedo (SSA) in South African and South American biomass burning events. The retrieved results were validated with collocated Aerosol Robotic Network (AERONET) measurements. The validation outcomes suggest: (1) within approximately one standard deviation, aerosol SSA retrieved from MODIS data agrees well with collocated AERONET results; (2) aerosol SSA in South America has larger spatial variation than aerosol SSA in South Africa. The accuracy of the retrieved aerosol SSA from MODIS data indicates that this product can help to better understand how aerosols affect the regional and global climate.